Biodiversity Development Assessment Report (BDAR)

Mulwala Solar Farm, Mulwala

Prepared for

ESCO C/O- RPS Group

Final / May 2018

2/235 Maitland Road Mayfield NSW 2304
PO Box 360 Waratah NSW 2298
matt.doherty@mjdenvironmental.com.au
MJDenvironmental.com.au
0416 208 684

DOCUMENT STATUS

Project Particulars			
Project Name	BDAR: Mulwala Solar Farm, Mulwala		
Job Number	18011		
Client	ESCO c/o- RPS Group		
Status	Draft		
Version	**Date**	**Prepared by**	**Details**
V1	24-5-2018	AC/MD	Draft for client review
V2	30-8-2018	AC/MD	Final for client submission

Approval for use:

Matt Doherty

30 May 2018

Disclaimer

This document may only be used for the intended purpose for which it was commissioned by the client in accordance with the contract between MJD Environmental and client. This report has been prepared in response to an agreed scope and based on available data including that supplied by the client. It has been assumed that all supplied information is both accurate and current. This report, results and outcome are accurate at date of production and subject to change over time along with the legislative and policy framework under which it was prepared.

MJD Environmental Pty Limited will not be liable or responsible whatsoever for or in respect of any use of or reliance upon this report and its supporting material by any third party. Unauthorised use of this report in any form whatsoever is prohibited.

EXECUTIVE SUMMARY

MJD Environmental Pty Limited has been engaged by RPS Group C/O- ESCO Pacific to prepare a Biodiversity Development Assessment Report (BDAR) for the construction and operation of the Mulwala Solar Farm, Mulwala, NSW.

The Biodiversity Development Assessment Report has been prepared as part of an Environmental Impact Statement (EIS) for the SSD of the Mulwala Solar Farm and aims to address the Secretary's Environmental Assessment Requirements (SEARs) issued on 5 February 2018.

In addition, preliminary assessment was also undertaken having regard to those threatened entities listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Based on assessment of the BAM 2017 and consultation with the NSW OEH, the site has been determined to qualify for a Streamlined (Paddock Tree) Assessment. As such the methodology, assessment and BDAR adheres to the BAM 2017 for Streamlined (Paddock Tree) Assessment.

Impact Avoidance & Mitigation

A package of avoidance and mitigation measures have been described in this BDAR associated with the project. These measures have been incorporated into the design (avoidance) in the first instance with mitigation measures assessed for the construction and operational phases of the project.

Impact Analysis

The proposal will result in the removal of 34 Paddock Trees of which 33 require ecosystem credits. In accordance with the BAM (2017), a total of 30.75 ecosystem credits are required to offset the loss.

A preliminary assessment under the EPBC Act determined the proposed action is unlikely to have an impact to MNES based on the assessment criteria set out in relevant Commonwealth policies and advices as at the time of this assessment.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF PLATES

APPENDICES

GLOSSARY OF TERMS AND ABBREVIATIONS

Term/ Abbreviation	Meaning
BC Act	Biodiversity Conservation Act 2016
BS Act	Biosecurity Act 2016
Council	Federation Council
DoEE	Commonwealth Department of the Environment & Energy
DPE	NSW Department of Planning and Environment
DPI Water	NSW Department of Primary Industries – Water
EP&A Act	NSW Environmental Planning and Assessment Act 1979
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
ha	hectare
LGA	Local Government Area
LLS Act	Local Land Services Act
NV Act	Native Vegetation Act 1995 (Repealed)
OEH	NSW Office of Environment and Heritage
TSC Act	NSW Threatened Species Conservation Act 1995 (Repealed)

1 Introduction

MJD Environmental Pty Limited has been engaged by RPS Group C/O- ESCO Pacific to prepare a Biodiversity Development Assessment Report (BDAR) for the construction and operation of the Mulwala Solar Farm, Mulwala, NSW (Refer to **Figure 1**).

1.1 Description of Proposal

The proposed Mulwala Solar Farm (MSF) project is a utility scale renewable energy project that will generate up to 80 MW of clean and renewable energy. The solar farm will comprise 300,000 solar photovoltaic (PV) modules, known more commonly as 'PV modules' or 'solar panels'. The solar panels use the same type of technology as commonly used in residential scale solar installations throughout Australia but are larger in size to those used residential applications.

The solar panels will be installed on ground-mounted frames that will slowly track the daily horizontal movement of the sun. The solar panels and horizontal tracking systems will be mounted in rows that will be electrically connected into arrays before being converted from direct current (DC) to alternating current (AC) electricity, which is the standard form of electricity used throughout Australia.

Electricity will then be fed, via an underground, on-site, high voltage power reticulation system, into the local electricity network through the Essential Energy Mulwala 132 kV substation.

The main items to be established for the project will include:

- 300,000 solar panels in regular arrays.
- Metal mounting piles and frames.
- Aboveground and underground DC cabling.
- Central inverters, step up transformers, and switchgear.
- Underground AC cabling.
- Main step up transformer and associated equipment.
- Internal vehicle access tracks.
- Perimeter safety fencing and security system.
- Supervisory control and data acquisition (SCADA) control systems.
- Site office, staff amenities, and maintenance shed.
- Permanent all-weather access and access road.
- Temporary site compound, lay-down area, and equipment storage areas during construction.
- Battery Storage Area

It is expected that the construction phase for the project will take approximately nine months from initial site works through to commissioning and is anticipated to have a 40 year operational life span.

During construction there will be up to 130 staff and contractors employed, while during operations there will be up to four staff for maintenance and monitoring activities.

The project has been designed to such that it will avoid sensitive features (where possible) to ensure the impacts of the development are minimised. At the conclusion of the project, all site infrastructure will be removed and the site rehabilitated to enable agricultural activities to resume.

Refer to **Figure 2** for a Site Map and **Appendix A** for a plan of the proposal.

1.2 Aims & Objectives

The proposed Mulwala Solar Farm has been deemed to be a State Significant Development (SSD) under the State and Regional Development State Environment Planning Policy (SEPP).

The Biodiversity Development Assessment Report has been prepared as part of an Environmental Impact Statement (EIS) for the SSD of the Mulwala Solar Farm and aims to address the Secretary's Environmental Assessment Requirements (SEARs) issued on 5 February 2018.

This BDAR will specifically address biodiversity issues outlined in the SEARs and are as follows:

> ***Biodiversity*** *– Including an assessment of the biodiversity values and the likely biodiversity impacts of the development in accordance with the Biodiversity Conservation Act 2016 (NSW), a detailed description of the proposed regime for minimising, managing and reporting on the biodiversity impacts of the development over time, and a strategy to offset any residual impacts of the development in accordance with the Biodiversity Conservation Act (2016)*

In addition, preliminary assessment was also undertaken having regard to those threatened entities listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

This BDAR is based on an application of the NSW Biodiversity Assessment Methodology 2017 (BAM), which provides a framework for assessing the developments impact on biodiversity. A two stage investigation path was performed in accordance with the BAM as listed below:

Stage 1 – Biodiversity Assessment; and

Stage 2 – Impact Assessment.

Based on assessment of the BAM 2017 and consultation with the NSW OEH, the site has been determined to qualify for a Streamlined (Paddock Tree) Assessment. As such the methodology, assessment and BDAR adheres to the BAM 2017 for Streamlined (Paddock Tree) Assessment.

1.3 Site Particulars

The following nomenclature has been used in this report (Refer to **Figure 1**):

- Project Boundary - Refers to lands controlled by the client
- Study Area – Refers to lands assessed as part of the proposal within the project boundary
- Site – Refers to the development area within the Study Area. This area includes all matters that form the proposal including construction area, operational area and servicing.

Locality	Mulwala
Land Title	Lot 100 DP100773, Lot 103 DP 752290 Lot 114 DP 752290 Lot 116 DP 752290, Lot 125 DP 752290, Lot 132 DP 752290, Lot 1 DP 134511, Lot 2 DP134511, Lot 3 DP 134511, Lot 4 DP134511, Lot 5 DP134511, Lot 6 DP134511, Lot 7 DP 134511
LGA	Federation Council
Area	Project Area: 377.9ha Study/Development Area 215.15ha

Zoning	The land is currently zoned R1 Primary Production and R2 Low Density Residential (DPE 2018)
Boundaries	The site is bound to the north and west by lands used for grazing and cropping, to the east by the Oaklands railway line and Savernake Rd with a narrow band of native vegetation between the transport corridors. The south is bound by Tocumwal Rd
Current Land Use	The land is currently used for cropping and grazing (primarily sheep). The site is primarily exotic cereal and pasture species that contains remnant paddock trees. An ephemeral depression and several farm dams are also present on the site.
Topography	The site topography is characterised by large flat floodplains, a central depression running north-east to south west through the northern parcel of the project area.

1.4 Qualifications & Licencing

Qualifications

This BDAR has prepared by Adam Cavallaro (BAAS# 18056) and Matt Doherty (BAAS #17044) accredited BAM Assessors.

Field Work for the BDAR was carried out by Adam Cavallaro and Phoebe Smith (of MJD Environmental Pty Ltd.

Refer to **Appendix D** for personnel qualifications.

Licencing

Research was conducted under the following licences:

- NSW National Parks and Wildlife Service Scientific Investigation Licence SL101684 (Valid 28 February 2019).
- Animal Research Authority (Trim File No: 16/170) issued by NSW Department of Primary Industries (Valid 8 February 2019).
- Animal Care and Ethics Committee Certificate of Approval (Trim File No: 16/170) issued by NSW Department of Primary Industries (Valid 8 February 2019).

Figure 1 Site Map

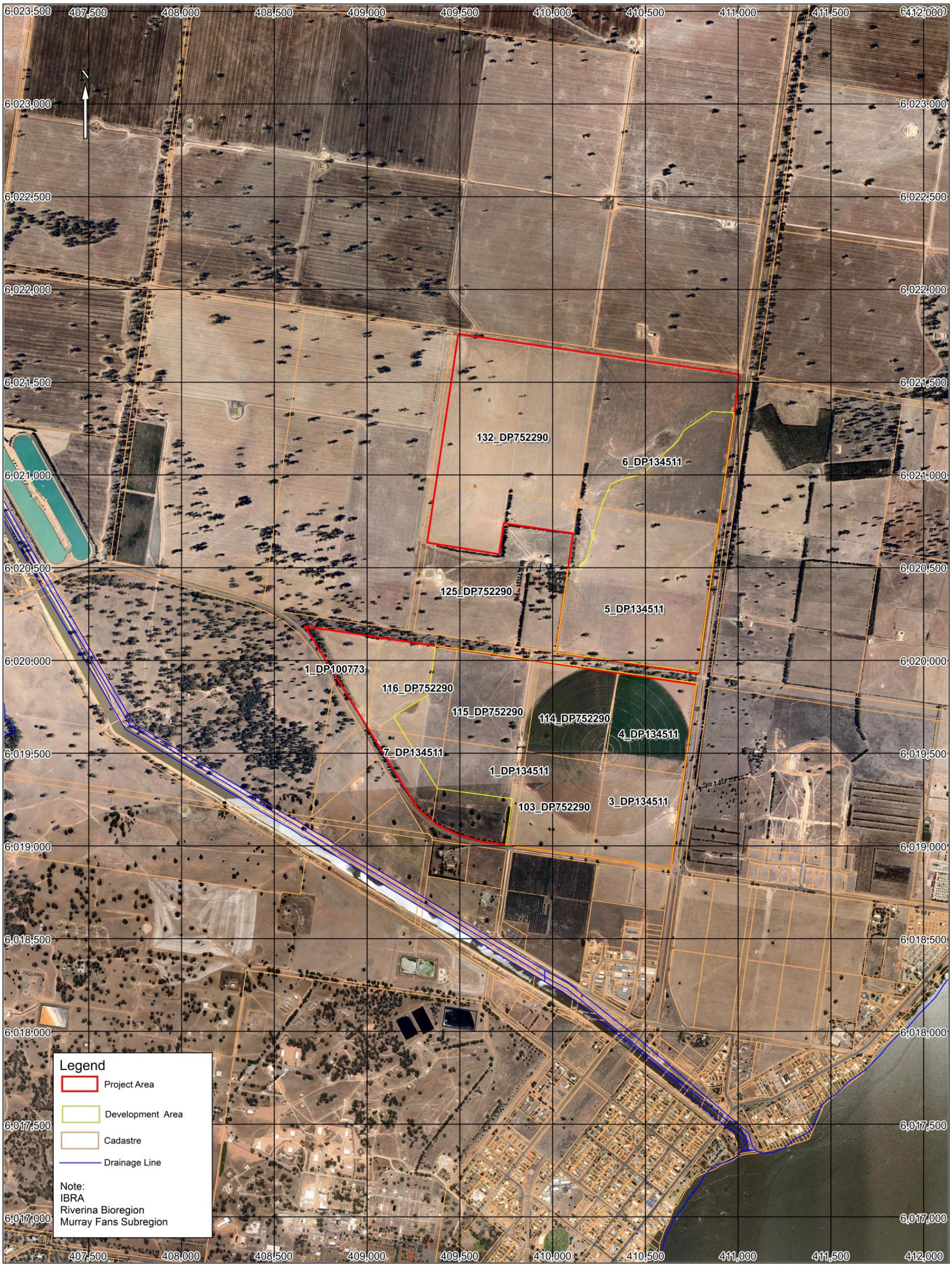


Figure 1: Site Map
Client: ESCO Pacific

0 875
meters
Scale 1:17,500

Datum/Projection::
GDA1994 MGA Zone 55
Date:25/5/2018
Version: 1.0

Data Source:
Aerial - Nearmap (2018)
Data: RPS & MJD Environmental (2018)

Project Files\18011 - Mulwala Solar Farm, Mulwala\5. GIS\WOR\18011_Mulwala_BDAR Figs_240518.WOR

STAGE 1 BIODIVERSITY ASSESSMENT

2 Development Site Footprint

The development site footprint has undergone several redesigns to reduce impacts on native vegetation within the original project boundary.

Prior to undertaking field surveys, a desktop review of the project area was carried to identify potential areas of avoidance regarding native vegetation. It was the aim to restrict the proposed development to areas of cleared land (within the project boundary) where known agricultural practices have been carried historically.

The desktop assessment identified areas of potential native vegetation that were to be excluded from the study area, primarily vegetation identified along boundaries, and a large depression (that is periodically inundated) which is partially mapped as regulated land under the LLS Act.

During the initial site assessment, further refinement of the Study Area was undertaken to avoid impacts on additional biodiversity values observed. All native vegetation within the refined Study Area was determined to meet the criteria of a streamlined paddock tree assessment. At this stage consultation with the Office of Environment and Heritage and the Local Land Services was carried out to confirm whether the site may qualify for a streamlined assessment in accordance with Appendix 1 of the Biodiversity Assessment Methodology (2017). The response from both agencies acknowledged that the study area appeared (via aerial photo analysis) to qualify for a streamlined assessment for paddock trees.

To ensure a streamlined assessment was the most appropriate assessment pathway, further review leading to refinement of the study area was carried to avoid areas that may not meet all required criteria, such as groups of trees greater than three.

The final development footprint assessed herewith avoids all planted windrows, to further reduce impacts on potential threatened species habitat that may be removed as part of the development footprint.

3 Landscape Context

The determination of the Study Area to qualifying for a *Streamlined Assessment – Paddock Trees* restricts the landscape assessment to the following attributes:

- Identify Interim Biogeographic Regionalisation of Australia (IBRA) bioregions and IBRA subregions
- Native vegetation cover is only assessed for the area of the Subject Land i.e. project boundary.

3.1 Interim Biogeographic Regionalisation of Australia (IBRA)

Bioregion

The Study Area occurs wholly within the Riverina Bioregion. The Riverina Bioregion is an ancient riverine plain and alluvial fans composed of unconsolidated sediments with evidence of former stream channels. Vegetation consists of river red gum and black box forests, box woodlands, saltbush shrublands, extensive grasslands and swamp communities (Thackway & Cresswell 1995). This Bioregion is borders the Southwest slopes bioregions to the north and east, the Murray darling depression to the south west and the Victorian midlands bioregion to the south.

Subregion

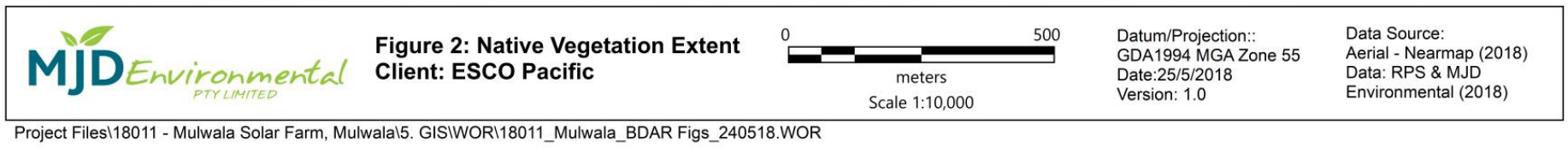
The Study Area occurs wholly within the Murray Fans subregion.

3.2 Native Vegetation Cover

The native vegetation cover of the project boundary area was assessed using Geographic Information Systems (GIS) and was calculated by estimating the percent cover (in accordance with section 4.3.2.4 BAM 2017) of native vegetation within the Project Area.

The native vegetation extent has been assessed as 0-10% of the Project Area.

Figure 2 Native Vegetation Extent



Project Files\18011 - Mulwala Solar Farm, Mulwala\5. GIS\WOR\18011_Mulwala_BDAR Figs_240518.WOR

4 Native Vegetation

Desktop analysis of vegetation within the Study Area, site and its surrounds were informed by large-scale vegetation mapping projects and aerial photography, including:

- OEH VIS Classification Database
- Preliminary consultation of the Riverina Bioregion Vegetation Mapping (NPWS 1999) to determine the broad plant community types of the Study Area;
- GIS analysis including - Aerial Photograph Interpretation (API) and consultation of topographic map (Scale 1:25,000) layers for the site; and

4.1 Native Vegetation Extent

The extent of native vegetation within the Study Area is sparse and discontinuous in the landscape due to the extensive agricultural practices on the subject land such as cropping and grazing. Native vegetation observed within the Study Area was limited to canopy cover of paddock trees, a small isolate group of trees with a disturbed exotic understorey and planted native tree windrows, planted after 1990 and excluded from the study area.

The Study Area is generally cleared due to current land use being for cropping and sheep grazing. Paddocks have a low diversity of flora species primarily exotic species that include *Triticum aestivum* (Wheat), *Hordeum* sp. (Barley) and *Heliotropium europaeum* (Heliotrope). Vegetation at the time of assessment had been cropped with mainly stubble remaining (grass species), and dense patches of Heliotrope. The native grass species *Chloris truncata* was observed in the paddocks, this species was only observed very sporadically across the Study Area.

The cleared area includes an ephemeral depression that is devoid of native vegetation and has been routinely used for various cereal crops over the past 50 years particularly in dry period (pers comm. landowner). This area has also been routinely ploughed. Vegetation cover in this area was observed to be consistent with the remaining cropped / pasture improved landscape.

All exotic pasture areas do not provide threatened species habitat and are recognised as exotic vegetation which does not generate biodiversity credits.

Plate 1 & 2: Typical Cropping and grazing land within the Study Area

Paddock Trees

The Project Boundary area has a total of 86 paddock trees, of which 57 are within the Study Area.

Paddock trees are defined in Appendix 1 of (BAM 2017) as follows:

- *The trees located on category 2 land are surrounded by category 1 land on the regulatory maps under the Biodiversity Conservation Act, or*
- *The native vegetation that comprises the groundcover is:*
    - *Less than 50% of the cover of indigenous species of vegetation, and*
    - *Not less than 10% of the area is covered with vegetation (whether dead or alive), and*
    - *The assessment is made at the time of year when the proportion of the amount of indigenous vegetation in the area to the amount of non-indigenous vegetation in the area is likely to be at its maximise and*
- *The foliage cover for the tree growth form group is less than 25% of the benchmark for tree cover for the most likely plant community type, or*
- *It is a tree more than 50m away from any living tree that is greater than 20cm DBH and the tree is located on category 2 land that is surrounded by category 1 land; or it is in a group of 3 or fewer living trees within a distance of 50m of each other, that in turn , are greater than 50m from the next living tree that is greater than 20cm DBH and located on Category 2 land that is surrounded by category 1 land.*

The current version of the Native Vegetation Regulatory Map (May 2018), only provides mapping of land categories - Category 2 Vulnerable Land, Category 2 Sensitive Regulated Lands and lands exempted from the *Local Land Services Act 2013* (LLS).

Any lands that may qualify as Category 1 unrestricted management and Category 2 code-based management is yet to be released. To determine if land with the Study Area aligns with criteria for these two categories, the definition outlined in the LLS Act has been use for self-assessment and confirmed with relevant OEH and LLS authorities.

All paddock trees assessed on site are classed Category 2 land, as trees where present as of January 1990. The paddock trees are surrounded by Category 1 land as this vegetation has been cleared of native vegetation since 1990.

Plate 3 & 4: Typical Paddock Tree within the Study Area

4.2 Floristic Survey

A site assessment and floristic survey were carried out within the Study Area over three days (16-18th April 2018) by two ecologists. Initial site assessments were carried out by traversing the site by vehicle and by foot to provide an understanding of vegetation and biodiversity values within the Study Area and refine the development footprint to exclude biodiversity values where possible.

Due to the highly disturbed nature of the Study Area, the Paddock tree method outlined below was used to assessment vegetation.

BAM - Paddock Tree Assessment

The Paddock Tree streamline assessment was carried to record all Paddock trees in the Study Area.

Each Paddock tree was recorded using a handheld Trimble Differential-GPS unit. Each tree had the following attributes recorded.

- Species name to genus;
- Diameter at Breast height;
- Hollows Present/absent and number of hollows;
- Any other habitat attributes e.g. termite terrain, nests;
- Height of tree; and
- Canopy spread.

This information was used to determine the assessment class of each tree.

The Classes are as follows:

Class1: paddock tree that are<20cm DBH, or tree that meets the definition of trees with negligible biodiversity value*

Class 2: Paddock trees that are>20cm DBH and less than the large tree benchmark for the most likely plant community type

Class 3: Paddock trees that are greater than or equal to the Large tree benchmark for the most likely plant community type.

*Paddock trees with negligible biodiversity value are those trees identified as class 1 paddock trees and do not contain hollows.

Trees classed as Class 2 and Class 3 were all assessed for habitat suitability for threatened species associated with the PCT the tree species are most likely to represent.

4.3 Identification of Plant Community Type

The identification of PCTs within the Study Area has been restricted to the identification of paddock tree species to indicate what community may have been present prior to land clearing in the area, and visual observations of adjacent roadside vegetation.

The streamlined assessment module for the clearing of paddock trees requires the assessor to nominate up to three candidate PCTs that:

- *Include the species of the paddock tree being cleared as one of its dominant tree species according to information in the BioNet Vegetation Classification, and*
- *Is a PCT that is associated with all the threatened species assessed as likely to use the paddock tree as habitat.*

In addition, the PCTs nominated are to address the seven attributes to identify credit class for ecosystem credits as per section 11.3 of the BAM (2017).

The three PCTs nominated which all paddock tree species are dominant species are:

- PCT 75: Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina region and Western NSW South Western Slopes Bioregion
- PCT 76: Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions
- PCT 80: Western Grey Box – White Cypress Pine tall woodland on loan soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina

Table 1 Paddock Tree Table

Species	DBH (cm)	Height range (m)	Canopy Width Range (m)	Hollow	Tree Class
Eucalyptus melliodora	119	16-20m	16-20m	Present	3
Eucalyptus melliodora	155	21-25m	16-20m	Present	3
Eucalyptus microcarpa	144	11-15m	16-20m	Present	3
Eucalyptus microcarpa	98	11-15m	11-15m	Absent	3
Eucalyptus microcarpa	129	11-15m	11-15m	Present	3
Eucalyptus microcarpa	95	16-20m	11-15m	Present	3
Eucalyptus microcarpa	97	16-20m	5-10m	Present	3
Eucalyptus melliodora	115	16-20m	16-20m	Present	3
Casuarina Luehmannii	65	11-15m	5-10m	Present	3
Eucalyptus microcarpa	114	11-15m	11-15m	Absent	3
Eucalyptus microcarpa	125	11-15m	5-10m	Present	3
Eucalyptus microcarpa	118	16-20m	16-20m	Present	3
Eucalyptus microcarpa	74	11-15m	11-15m	Absent	3
Eucalyptus microcarpa	54	11-15m	5-10m	Absent	3
Eucalyptus melliodora	112	11-15m	5-10m	Present	3
Eucalyptus melliodora	98	11-15m	11-15m	Absent	3
Eucalyptus albens	137	16-20m	16-20	Present	3
Dead stag	109	11-15m	16-20	Present	3
Dead stag	109	11-15m	16-20	Present	3
Eucalyptus microcarpa	66	16-20m	5-10m	Absent	3
Eucalyptus microcarpa	51	11-15m	5-10m	Absent	3
Eucalyptus microcarpa	51	11-15m	5-10m	Absent	3
Eucalyptus microcarpa	53	16-20m	5-10m	Absent	3
Eucalyptus microcarpa	29	5-10m	<5m	Absent	2
Eucalyptus microcarpa	26	5-10m	<5m	Absent	2
Eucalyptus microcarpa	23	5-10m	<5m	Absent	2
Eucalyptus microcarpa	57	21-25m	11-15m	Absent	3
Eucalyptus microcarpa	52	16-20m	5-10m	Absent	3
Eucalyptus microcarpa	41	11-15m	5-10m	Absent	3
Eucalyptus albens	42	11-15m	5-10m	Absent	3
Eucalyptus albens	44	16-20m	5-10m	Absent	3
Eucalyptus albens	69	16-20m	11-15m	Absent	3
Eucalyptus microcarpa	82	21-25m	11-15m	Present	3
Eucalyptus microcarpa	88	16-20m	16-20m	Present	3
Eucalyptus microcarpa	102	16-20m	16-20m	Present	3
Eucalyptus microcarpa	119	11-15m	11-15m	Absent	3
Eucalyptus camaldulensis	34	5-10m	5-10m	Absent	3
Eucalyptus microcarpa	51	5-10m	5-10m	Absent	3
Eucalyptus microcarpa	30	5-10m	5-10m	Absent	3
Eucalyptus melliodora	28	5-10m	5-10m	Absent	2
Eucalyptus melliodora	24	5-10m	5-10m	Absent	2
Eucalyptus melliodora	116	16-20m	11-15m	Present	3
Eucalyptus melliodora	99	11-15m	16-20m	Present	3
Casuarina Luehmannii	20	5-10m	<5m	Absent	1
Callitris glaucophylla	90	5-10m	5-10m	Absent	3
Callitris glaucophylla	125	11-15m	5-10m	Absent	3
Eucalyptus melliodora	165	11-15m	16-20	Present	3
Callitris glaucophylla	73	11-15m	5-10m	Absent	3
Callitris glaucophylla	75	5-10m	5-10m	Absent	3
Eucalyptus melliodora	146	16-20m	16-20m	Present	3

Species	DBH (cm)	Height range (m)	Canopy Width Range (m)	Hollow	Tree Class
Eucalyptus melliodora	161	16-20m	11-15m	Present	3
Eucalyptus melliodora	113	16-20m	11-15m	Present	3
Eucalyptus melliodora	142	16-20m	11-15m	Present	3
Eucalyptus melliodora	126	16-20m	11-15m	Present	3
Eucalyptus melliodora	109	16-20m	11-15m	Absent	3
Eucalyptus melliodora	131	16-20m	11-15m	Present	3
Eucalyptus melliodora	133	11-15m	11-15m	Present	3
Eucalyptus melliodora	143	11-15m	11-15m	Present	3
Eucalyptus melliodora	149	16-20m	16-20m	Present	3
Eucalyptus melliodora	194	21-25m	16-20m	Present	3
Eucalyptus melliodora	149	21-25m	16-20m	Present	3
Eucalyptus melliodora	143	21-25m	16-20m	Present	3
Eucalyptus melliodora	100	16-20m	11-15m	Absent	3
Eucalyptus melliodora	103	11-15m	11-15m	Present	3
Eucalyptus microcarpa	62	11-15m	5-10m	Absent	3
Eucalyptus microcarpa	115	11-15m	5-10m	Present	3
Eucalyptus microcarpa	132	21-25m	11-15m	Present	3
Eucalyptus microcarpa	196	21-25m	11-15m	Present	3
Eucalyptus microcarpa	184	16-20m	16-20m	Present	3
Eucalyptus microcarpa	110	16-20m	16-20m	Present	3
Eucalyptus microcarpa	111	11-15m	5-10m	Present	3
Eucalyptus microcarpa	137	16-20m	5-10m	Present	3
Callitris glaucophylla	120	5-10m	5-10m	Present	3
Callitris glaucophylla	92	5-10m	5-10m	Absent	3
Eucalyptus microcarpa	134	11-15m	11-15m	Present	3
Eucalyptus camaldulensis	40	5-10m	<5m	Absent	3
Eucalyptus camaldulensis	18	5-10m	<5m	Absent	1
Eucalyptus camaldulensis	29	5-10m	<5m	Absent	2
Eucalyptus camaldulensis	81	11-15m	5-10m	Absent	3
Eucalyptus melliodora	132	21-25m	11-15m	Present	3
Eucalyptus melliodora	127	21-25m	11-15m	Present	3
Eucalyptus melliodora	194	21-25m	11-15m	Present	3
Eucalyptus melliodora	233	21-25m	11-15m	Present	3
Eucalyptus melliodora	5	5-10m	<5m	Absent	1
Eucalyptus melliodora	10	5-10m	<5m	Absent	1
Eucalyptus melliodora	19	5-10m	<5m	Absent	1

5 Threatened Species

5.1 Desktop Assessment

A review of threatened species information was undertaken to provide context and understanding of biodiversity values occurring within the Study Area. Information reviewed included:

- Online database searches involving a 10-km buffer around the site to provide potentially occurring threatened flora and fauna and migratory species under both the BC Act and EPBC Act:
    - NSW Bionet (accessed 13 March 2018)
    - Commonwealth Protected Matters of National Significance search tool (accessed 13 March 2018)
- BioNet Vegetation Classification – Threatened species associated with nominated PCT

5.2 Ecosystem Credit Species

The PCT identification tool (BioNet Vegetation Classification) has been used to develop a list of ecosystem credit species associated with the PCTs represented within the Study Area. Ecosystem Credit Species are reliably predicted to occur within the nominated PCTs, and are assumed to occur on site, unless habitat features used by threatened species have been substantially impacted and removed from the study area. These species are presented in **Table 2**.

Table 2 : Ecosystem Credit Species

Scientific Name	Common Name	BC Act	EPBC Act	Paddock Trees	PCT 75	PCT 76	PCT 80
**Anthochaera phrygia*	Regent Honeyeater	CE	CE		x		
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V		Yes	x	x	x
Calyptorhynchus lathami	Glossy Black Cockatoo	V		Yes	x	x	x
Certhionyx variegatus	Pied Honey eater	V					x
Chthonicola sagittata	Speckled Warbler	V		Yes	x		x
Circus assimilis	Spotted Harrier	V		Yes	x		
Daphoenositta chrysoptera	Varied Sittella	V		Yes	x	x	x
Falco hypoleucos	Grey Falcon	E		Yes	x	x	x
Glossopsitta pusilla	Little Lorikeet	V		Yes	x		
Grantiella picta	Painted Honeyeater	V	V	Yes		x	x
**Haliaeetus leucogaster*	White-bellied Sea-eagle	V		Yes	x		x
**Hieraaetus morphnoides*	Little Eagle	V		Yes	x		x
**Lathamus discolor*	Swift Parrot	E	CE	Yes	x		x
Lophochroa leadbeateri	Major Mitchell	V		Yes		x	x
Melanodryas cucullata cucullata	Hooded Robin	V		Yes	x	x	x
Melithreptus gularis gularis	Black-chinned Honeyeater	V		Yes		x	x

Scientific Name	Common Name	BC Act	EPBC Act	Paddock Trees	PCT 75	PCT 76	PCT 80
Neophema pulchella	Turquoise Parrot	V				x	x
**Ninox connivens*	Barking Owl	V		Yes	x		x
Pachycephala inornata	Gilbert's Whistler	V					x
Petroica boodang	Scarlet Robin	V		Yes	x		x
Petroica phoenicea	Flame Robin	V		Yes			x
**Polytelis swainsonii*	Superb Parrot	V	V	Yes			x
Pomatostomus temporalis temporalis	Grey-headed Babbler	V		Yes	x	x	x
Stagonopleura guttata	Diamond Firetail	V			x		x
**Tyto novaehollandiae*	Masked Owl	V		Yes			x
Nyctophilus corbeni	Corben's Long-eared Bat	V	V	Yes			x
**Pteropus poliocephalus*	Grey-headed Flying-fox	V	V		x		
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V		Yes			x
Antechinomys laniger	Kultarr	E				x	
**Phascolarctos cinereus*	Koala	V	V	Yes			x

Key:

V = Vulnerable E = Endangered CE = Critically Endangered *Dual Credit Species

5.2.1 Ecosystem Species Excluded from the Assessment

The vegetation on site has been assessment to provide limited habitat for a small number of species, due to the site being primarily cleared grazing land with paddock trees.

The habitat for each of the ecosystems species known to use Paddock trees (Refer to **Table 1**) has been identified and attributes associated with paddock trees and each species was considered during habitat assessment.

5.3 Species Credit Species

Specie Credit Species are species that cannot be reliably predicted to use an area based on habitat surrogates. Species credit species that are likely to occur within the study area must be surveyed to determine presences/absence or provide an expert report. In the absence of either of these the species will be presumed to be present within the study area.

The conditions of vegetation and habitat within the study area can be assessed by an accredited assessor to have sufficient site degradation of the key habitat constraints associated with species credits species, therefore is unlikely to utilise the site and not requiring further assessment. These species are presented in **Table 3** and a habitat assessment for species credit species in **Table 4**.

Table 3 Species Credit Species

Scientific Name	Common Name	BC Act	EPBC Act	Survey Period	Paddock Trees	PCT 75	PCT 76	PCT 80
Birds								
Anthochaera phrygia	Regent Honeyeater	CE	CE	Sept-Dec		x		
Burhinus grallarius	Bushstone Curlew	E		All year	Yes	x	x	x
Calyptorhynchus banksii samueli	Red-tailed Black-Cockatoo (inland subspecies)	V		May -Dec	Yes		x	
Calyptorhynchus lathami	Glossy Black Cockatoo	V		Mar- Aug	Yes	x	x	x
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V		All year			x	
Haliaeetus leucogaster	White-bellied Sea-eagle	V		July- Dec (Breeding)	Yes	x	x	x
Hieraaetus morphnoides	Little Eagle	V		Aug- Sept (Breeding)	Yes	x	x	x
Lathamus discolor	Swift Parrot	E	CE	May-August	Yes	x	x	x
Lophochroa leadbeateri	Major Mitchell	V		Sept -Dec			x	x
Ninox connivens	Barking Owl	V		May-December	Yes	x	x	x
Polytelis swainsonii	Superb Parrot	V	V	Sept- Nov	Yes		x	x
Tyto novaehollandiae	Masked Owl	V		May-Aug (Breeding)	Yes		x	x
Amphibian								
Crinia sloanei	Sloane's Froglet	V		July- Aug			x	x
Mammals								
Chalinolobus picatus	Little Pied Bat	V		All year	Yes		x	
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Oct-Dec (Breeding)			x	
Cercartetus nanus	Eastern Pygmy - Possum	V		All year				x
Petaurus norfolcensis	Squirrel Glider	V		All year	Yes		x	x

Phascogale tapoatafa	Brush-tailed Phascogale	V		All year	Yes		x	
Phascolarctos cinereus	Koala	V	V	All year	Yes		x	x

Key:

V = Vulnerable E = Endangered CE = Critically Endangered

Table 4 Species Credit Species Habitat Assessment

Scientific Name	Common Name	Habitat requirement	Habitat present on development site	Species requires further assessment
Birds				
Anthochaera phrygia	Regent Honeyeater	The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River She-Oak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. In the last 10 years Regent Honeyeaters have been recorded in urban areas around Albury where woodlands tree species such as Mugga Ironbark and Yellow Box were planted 20 years ago. Paddock trees are not indicated as important habitat attributes for Regent Honeyeaters as per the OEH Threatened Species Data Collection. The Site is also located outside important habitat areas (Breeding) that have been developed by OEH	Unlikely	Yes
Burhinus grallarius	Bushstone Curlew	Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Species is mainly found in western slopes and plains and the Riverina. Paddock Trees are important especially where there is fallen timber, thus further assessment is required	Likely	Yes
Calyptorhynchus banksii samueli	Red-tailed Black-Cockatoo (inland subspecies)	Found in a wide variety of habitats. Prefer *Eucalyptus* forest and woodlands, particularly river red gum and coolabah lined water courses. In the arid zone usually occur mainly near eucalypts along larger watercourses and associated *Acacia* and *Casuarina* woodlands nearby. Also utilise grasslands, scrublands, wetlands and vegetation on floodplains. Although paddock trees with hollows > 12 cm are important habitat for this species and are present on site, the geographical location of the study area is south of this species known southerly distribution limit around Menindee.	Unlikely	No (outside geographic distribution)

Calyptorhynchus lathami	Glossy Black Cockatoo	The species is uncommon although widespread throughout suitable forest and woodland habitats, including a small population in the Riverina. In the Riverina, birds are associated with hills and rocky rises supporting Drooping She-Oak, but also recorded in open woodlands dominated by Belah (*Casuarina cristata*). This species is dependent on large hollow-bearing eucalypts for nest sites. Paddock trees are considered to be important habitat for this species.	Likely (Paddock Trees)	Yes
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (*Eucalyptus camaldulensis*) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains. This species has been recorded in the locality were large areas of remnant vegetation exist. This species is not dependent on Paddock trees. The site current does not support required habitat for his species. Surveys can be carried yearly, and for this reason will be surveyed during formal bird census.	Unlikely	Yes
Haliaeetus leucogaster	White-bellied Sea-eagle	In New South Wales it is widespread along the east coast, and along all major inland rivers and waterways. Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Breeding habitat consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Nest trees are typically large emergent eucalypts and often have emergent dead branches or large dead trees nearby which are used as 'guard roosts'. Nests are large structures built from sticks and lined with leaves or grass. Paddock trees are considered to be important habitat for this species.	Likely	Yes
Hieraaetus morphnoides	Little Eagle	Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter. Paddock Trees important. Paddock trees can provide important breeding habitat for this species.	Likely	Yes

Lathamus discolor	Swift Parrot	Migrates to the Australian south-east mainland between March and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there is abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Commonly used lerp infested trees include Inland Grey Box *E. microcarpa*, Grey Box *E. moluccana* and Blackbutt *E. pilularis*. Paddock trees are considered to be important habitat for this species.	Likely	Yes
Lophochroa leadbeateri	Major Mitchell's Cockatoo	Inhabits a wide range of treed and treeless inland habitats, always within easy reach of water. Feeds mostly on the ground, especially on the seeds of native and exotic melons and on the seeds of species of saltbush, wattles and cypress pines. Nesting, in tree hollows, occurs throughout the second half of the year.	Likely	Yes
Ninox connivens	Barking Owl	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Roost in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as Acacia and Casuarina species. This species may use paddock trees to extend foraging area from intact woodland	Likely	Yes
Polytelis swainsonii	Superb Parrot	In the Riverina the birds nest in the hollows of large trees (dead or alive) mainly in tall riparian River Red Gum Forest or Woodland. On the South West Slopes nest trees can be in open Box-Gum Woodland or isolated paddock trees. Species known to be used are Blakely's Red Gum, Yellow Box, Apple Box and Red Box. Paddock Trees are considered to be important nesting habitat, only *E. blakelyi, E. melliodora, E. albens, E. camaldulensis, E. microcarpa & E. polyanthemos*	Likely	Yes
Tyto novaehollandiae	Masked Owl	Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. Masked owls have been recording nesting in paddock trees.	Likely	Yes

Bats				
Chalinolobus picatus	Little Pied Bat	Occurs in dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress pine forest and mallee and Bimbil box woodlands. Roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings. Can tolerate high temperatures and dryness but need access to nearby open water. Paddock trees are considered important foraging and roosting habitat for this species.	Likely	Yes
Pteropus poliocephalus	Grey-headed Flying-fox	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines.	Likely	Yes
Amphibians				
Crinia sloanei	Sloane's Froglet	It is typically associated with periodically inundated areas in grassland, woodland and disturbed habitats. This species has been recorded from widely scattered sites in the floodplains of the Murray-Darling Basin, with the majority of records in the Darling Riverine Plains, NSW South Western Slopes and Riverina bioregions in New South Wales. Habitat for this species is highly disturbed with a dam devoid of vegetation and an ephemeral depression that current consists of exotic crops that have recently been cut and only stubble persist. That lack of viable habitat for this species indicates survey are unlikely to record this species.	Unlikely	Yes
Marsupials				
Cercartetus nanus	Eastern Pygmy - Possum	Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; an important pollinator of heathland plants such as banksias; soft fruits are eaten when flowers are unavailable. Shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests etc. Tree hollows are favoured. This species is not known to utilise Paddock trees.	Unlikely	No

Petaurus norfolcensis	Squirrel Glider	Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey. Require abundant tree hollows for refuge and nest sites. Paddock Trees are important habitat for this species but need to be at no more than 50 m apart.	Unlikely	Yes
Phascogale tapoatafa	Brush-tailed Phascogale	Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest. Nest and shelter in tree hollows with entrances 2.5 - 4 cm wide and use many different hollows over a short time span. Paddock Trees are important during breeding season (May-Jul), males may seek temporal refuge points in paddock trees with hollows	Likely (Paddock trees)	Yes
Phascolarctos cinereus	Koala	Inhabit eucalypt woodlands and forests in a fragmented distribution throughout eastern Australia. In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range but have been recorded in the southern tablelands. This species feeds on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Spend most of their time in trees but will descend and traverse open ground to move between trees. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size. Paddock trees are considered important habitat for this species	Likely (Paddock trees)	Yes

5.4 Candidate Species Surveys

The following species could not be conclusively ruled out from occurring on site due to each species potential utilisation of paddock trees for forage or roosting requirements.

Birds

- Regent Honeyeater *Anthochaera* phrygia
- Bushstone Curlew *Burhinus grallarius*
- Glossy Black Cockatoo *Calyptorhynchus lathami*
- White-bellied Sea-eagle *Haliaeetus leucogaster*
- Little Eagle *Hieraaetus morphnoides*
- Swift Parrot *Lathamus discolor*
- Major Mitchell's Cockatoo *Lophochroa leadbeateri*
- Barking Owl *Ninox connivens*
- Superb Parrot *Polytelis swainsonii*
- Masked Owl *Tyto novaehollandiae*

Bats

- Little Pied Bats *Chalinolobus picatus*
- Grey-headed Flying Fox *Pteropus poliocephalus*

Amphibians

- Sloan's Froglet *Crinia sloanei*

Marsupials

- Eastern Pygmy Possum *Cercartetus nanus*
- Squirrel Glider *Petaurus norfolcensis*
- Brush-tailed Phascogale *Phascogale tapoatafa*
- Koala *Phascolarctos cinereus*

All candidate species surveys where carried out in accordance with:

- *Threatened Biodiversity Survey and Assessment: Guidelines for development and activities* (DECC 2004); and
- *Threatened species survey and assessment guidelines: Field survey methods for fauna - Amphibian* (DECC 2009).

5.4.1 Weather Conditions

Field surveys were undertaken between the 16th April 2018 and 18th April 2018. The prevailing weather conditions during the survey are presented in a **Table 5** below.

Table 5 Prevailing Weather Conditions

Date	Min Temp (ºC)	Max Temp (ºC)	Rain (mm)	Wind (km/h) 9am / 3pm	Sunrise-Sunset
16 Apr 2018	13.2	22.3	0.0	W 17 to W 22	0641-1751
17 Apr 2018	7.3	23.2	0.0	SSW 20 to SSW 13	0642-1749
18 Apr 2018	4.5	25.4	0.0	E 15 to N 11	0643-1748

Sources: www.bom.gov.au/climate/dwo/201804/html/IDCJDW2145.201804.shtml
http://www.ga.gov.au/bin/geodesy/run/sunrisenset

5.4.2 Methodology

Fauna Survey Methods

Spotlighting

Spotlighting was undertaken with the use of a Lightforce Enforcer 140mm LED (376m @ 1 LUX) hand-held spotlight and head torch whilst traversing the Study Area by foot and vehicle. Areas of mature remnant vegetation along boundaries of the Study area, and all hollow bearing trees within the study area.

A total of 5-person hours of spotlighting was carried to target mammals and nocturnal bird species within the study area.

Target Species:

- Eastern Pygmy Possum (*Cercartetus nanus*), Squirrel Glider (*Petaurus norfolcensis*), Brush-tailed Phascogale (*Phascogale tapoatafa*), Koala *(Phascolarctos cinereus*) and Grey-headed Flying Fox (*Pteropus poliocephalus*)
- Barking Owl (*Ninox connivens*) and Masked Owl (*Tyto novaehollandiae*)

Avifauna Census

The observation of avifauna within the study area was undertaken via targeted diurnal census supplemented by opportunistic observations during other diurnal fieldwork (Refer to **Figure 3**). The diurnal census surveys were undertaken at dusk and dawn (early morning being a peak activity period for birds). 4-person hours of diurnal census were undertaken during peak dusk and dawn activity periods.

Nocturnal bird surveys were undertaken, and detail of methods employed is outlined in below under call playback survey techniques.

Target Species:

- Bushstone Curlew (*Burhinus grallarius*), Glossy Black Cockatoo (*Calyptorhynchus lathami*), Brown Treecreeper (*Climacteris picumnus victoriae*), White-bellied Sea- eagle (*Haliaeetus leucogaster*), Little Eagle (*Hieraaetus morphnoides*), Swift Parrot (*Lathamus discolor*), Major Mitchell's Cockatoo (*Lophochroa leadbeateri)* and Superb Parrot (*Polytelis swainsonii*).

Amphibian Survey

Amphibian surveys where carried in accordance with the *Threatened species survey and assessment guidelines: Field survey methods for fauna -Amphibian.* Nocturnal listening surveys and searches were conducted over two nights during the evenings of 16 and 17th April 2018.

Two dedicated 30-minute listening surveys over two nights were carried near the known ephemeral drainage area in the northern parcel of the subject land and the farm dam devoid of vegetation in the south eastern corner. Additionally, A 100m transect search of the ephemeral drainage area was carried as part of the surveys each night.

Rain was recorded in the Mulwala area on the 15th April 2018 with 2.8mm recorded at Mulwala Post Office. No rain was recorded during the two days of survey.

Microchiropteran Bats

Microbat surveys were undertaken by recording echolocation calls using the Anabat Express Detector units set to remotely record for the entire night (6pm to 6am). Two units were deployed within the study area for a period of 2 nights (each unit). Anabat units were placed with an emphasis on those areas deemed likely to provide potential foraging and flyway sites for microbats. The location of the Anabat sites are shown in **Figure 3**.

Bat call analysis was undertaken by Dr Anna McConville of Echo Ecology who is experienced in the analysis of bat echolocation calls. Each call sequence ('pass') was assigned to one of five categories, according to the confidence with which an identification could be made, being:

- Definite - Pass identified to species level and could not be confused with another species;
- Probable - Pass identified to species level and there is a low chance of confusion with another species;
- Possible - Pass identified to species level but short duration or poor quality of the pass increases the chance of confusion with another species;
- Species group - Pass could not be identified to species level and could belong to one of two or more species. Occurs more frequently when passes are short or of poor quality; or
- Unknown - Either background 'noise' files or passes by bats which are too short and/or of poor quality to confidently identify.

Appendix E contains the Anabat reports with all results, while **Figure 3** shows the Anabat locations.

Nocturnal Call Playback

The use of pre-recorded calls of Forest owls, Koala and Glider species that may occur within the Site and surrounding area were broadcast during the nocturnal surveys in an effort to receive a vocal response or to attract the species to the playback site. The calls were broadcast through an amplification system (25W megaphone) designed to project the sound for at least 1 km under still night conditions.

As described by Kavanagh and Peake (1993) and Debus (1995), the call of each species was broadcast for at least five minutes, followed by five minutes of listening, and stationary spotlighting. Following the final broadcast and listening, the area was spotlighted on foot. Species targeted included the Barking Owl (*Ninox connivens*), Masked Owl (*Tyto novaehollandiae*), Squirrel Glider (*Petaurus norfolcensis*), and Koala (*Phascolarctos cinereus*).

A total of three call playback sessions were undertaken over three separate nights. The location of the call playback sites is shown in **Figure 3**.

Secondary Indications and Incidental Observations

Opportunistic sightings of secondary indications (scratches, scats, diggings, tracks etc.) of resident fauna were noted. Such indicators included:

- Distinctive scats left by mammals;
- Scratch marks made by various types of arboreal animals;
- Nests made by various guilds of birds;
- Feeding scars on Eucalyptus trees made by Gliders;

- Whitewash, regurgitation pellets and prey remains from Owls;
- Aural recognition of bird and frog calls;
- Skeletal material of vertebrate fauna; and
- Searches for indirect evidence of fauna (such as scats, nests, burrows, hollows, tracks, and diggings).

5.4.3 Limitations

Limitations associated with this assessment report are presented herewith. The limitations have been taken into account specifically in relation to threatened species assessments, results and conclusions.

In these instances, a precautionary approach has been adopted; whereby 'assumed presence' of known and expected threatened species, populations and ecological communities has been made where relevant and scientifically justified to ensure a holistic assessment.

Seasonality & Conditions

The flowering and fruiting plant species that attract some nomadic or migratory threatened species, often fruit or flower in cycles spanning a number of years. Furthermore, these resources might only be accessed in some areas during years when resources more accessible to threatened species fail. As a consequence, threatened species may be absent from some areas where potential habitat exists for extended periods and this might be the case for nomadic and opportunistic species.

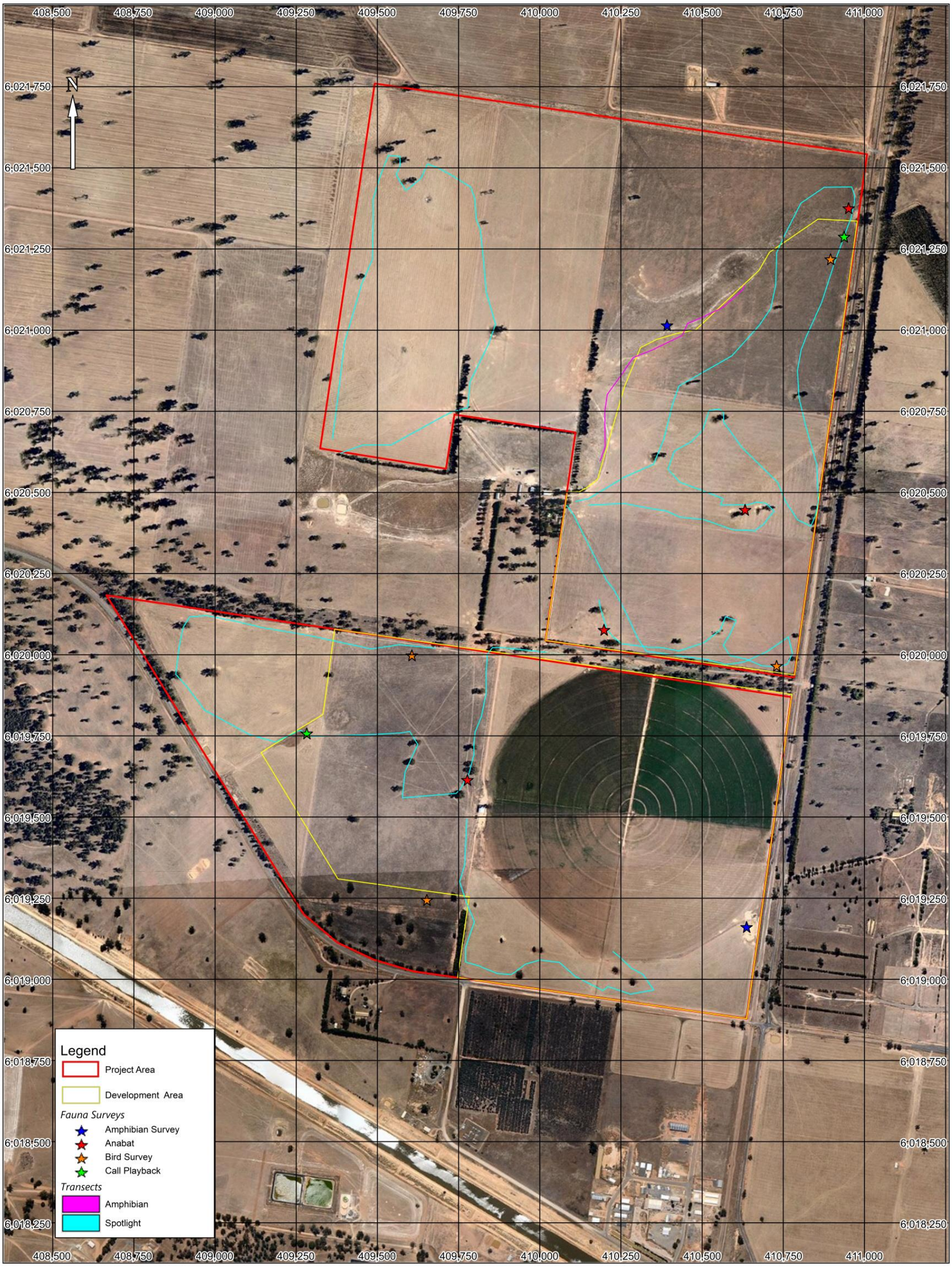
Data Availability & Accuracy

The collated threatened flora and fauna species records provided by Bionet Atlas of NSW Wildlife are known to vary in accuracy and reliability. This is usually due to the reliability of information provided to the National Parks and Wildlife Service (NPWS) for collation and/or the need to protect specific threatened species locations. During the review of threatened species records sourced from OEH Atlas of NSW Wildlife, consideration has been given to the date and accuracy of each threatened species record in addition to an assessment of habitat suitability within the study area.

Similarly, EPBC Protected Matters Searches provide a list of threatened species and communities that have been recorded within 10 km of the study area, or which have suitable habitat within the wider area, and are subject to the same inherent inaccuracy issues as the State derived databases.

In order to address these limitations in respect to data accuracy, threatened species records have only been used to provide a guide to the types of species that occur within the locality of the study area. Consequently, habitat assessment and the results of surveys conducted within the study area and surrounds have been used to assess the likelihood of occurrence of threatened species, populations and ecological communities to occur therein.

Figure 3 Fauna Survey Location



MJD Environmental PTY LIMITED

Figure 3: Fauna Survey
Client: ESCO Pacific

0 635
meters
Scale 1:10,000

Datum/Projection::
GDA1994 MGA Zone 55
Date:25/5/2018
Version: 1.0

Data Source:
Aerial - Nearmap (2018)
Data: RPS & MJD Environmental (2018)

Project Files\18011 - Mulwala Solar Farm, Mulwala\5. GIS\WOR\18011_Mulwala_BDAR Figs_240518.WOR

5.5 Fauna Survey Results

Mammals

Mammals where opportunistically observed during other diurnal fieldworks. Only common fauna species where observed including Eastern Grey Kangaroo, exotic species such as Red Fox, European Hare and domestic farmer animals such as Sheep and Cattle.

No nocturnal mammals including Eastern Pygmy Possum (*Cercartetus nanus*), Squirrel Glider (*Petaurus norfolcensis*), Brush-tailed Phascogale (*Phascogale tapoatafa*), Koala *(Phascolarctos cinereus*) and Grey-headed Flying Fox (*Pteropus poliocephalus*), were observed during spot lighting, or did not elicit a response during the nocturnal call play back from Squirrel Glider or Koala.

Grey-headed Flying-fox

The nocturnal surveys for Grey-headed flying-fox where not undertaken during the proposed survey (breeding survey) period outlined in the Threatened Biodiversity Data Collection

There were no obvious signs of a permanent or seasonal roosting camps within the Study Area, indicating that this species is unlikely to use the Study area for breeding. And is more likely to use the area for periodic foraging.

A search of the DoEE Flying fox monitoring viewer (DoEE 2018), which collates data from annual surveys (three per year), show that closest camp to the Study Area is approximately 52km south west in Numurkah and 83km east in Albury.

It is on this bases that it is recommended that no further surveys are carried.

Avifauna

A total of 31 bird species were recorded during targeted early morning and dusk census periods, as well as opportunistically during all other survey work. Species recorded included many common woodland species such as Rainbow lorikeets, Red Rump Parrots, Apostle Bird, Australian Magpie Corellas and Sulphur Crested Cockatoos. During the time of surveying forage in the form of Eucalypt blossom was limited, with only small number of large old Eucalypt presenting blossom. No threatened species where observed within the Study Area during formal surveys.

Two threatened species where observed adjacent to the Study Area within the vegetated Lambruck Lane that divides the study area into two parcels. The Grey-crowned Babbler was observed within this road verge each day and nest where also identified. The Flame Robin was also observed at the east corner of the road adjacent to the trainline.

A large number of diurnal raptor species were recorded within the site, including the Whistling Kite, Wedgetail Eagle, Peregrine Falcon, Nankeen Kestrel and the Brown Goshawk where all observed flying over the site during other diurnal fieldworks.

Masked Owl and Barking Owl

No threatened Owl species were heard responding to call backs played during the survey effort.

Call playback surveys and spotlighting was undertaken outside the prescribed survey time for breeding of each of these Owl species.

Swift Parrot

Diurnal avifauna surveys targeted threatened species including the Swift Parrot failed to detect an occurrence of this species. The current survey period for this species is May – August, as outlined in the Threatened Biodiversity Data Collection. The following data has been presented to validate surveys being undertaken prior to the survey period commencing.

In the autumn season leading up to the survey (survey dates 16 to 18 April 2018) and over the following week, Swift Parrot observations within the region and further north, as represented in the 'recent sightings' log of Birdline New South Wales and Birdline Victoria (http://www.eremaea.com/BirdlineRecentSightings.aspx?Birdline=1), as well as the species map of ebird (http://www.ebird.org), are summarised in Table 5. This summary provides an indication of Swift Parrot activity during the survey period.

Table 6 Observations from surrounding region and to the north in the time period of surveys

Date	Source / Observation Location
10 March 2018	eBird / Seymour
17 March 2018	Birdline / South Glory Cave Kosciuszko
25 March 2018	Birdline / Monga National Park
31 March 2018	eBird / Shepparton
1 April 2018	eBird, Birdline / Kamarooka
4 April 2018	eBird / Indigo
5 April 2018	Birdline / Echuca
22 March 2018 - 9 April 2018	eBird / Canberra, multiple observations every day over this period
9 April 2018	Birdline / Moruya Heads
11 April 2018	eBird, Birdline / Sydney
15 April 2018	eBird / Chiltern
16 April 2018	eBird / Chiltern
20 April 2018	eBird / Shepparton
21 April 2018	Birdline / Blackalls Park
24 April 2018	eBird / Campaspe
25 April 2018	eBird / Indigo
29 April 2018	eBird / Capertee Valley
29 April 2018	eBird, Birdline / Port Macquarie
30 April 2018	eBird, Birdline / Werakata

In Addition, The Study Area (based on OEH advice) is not located in an important habitat area, and paddock trees are not recognised as important attributes to habitat for this species (OEH -Threatened species Data Collection No further survey is required.

Regent Honeyeater

This species was not observed during surveys. This species is known to breed in three key locations in NSW, these localities are Capertee Valley, Bundarra-Barraba region and the Lower Hunter (OEH 2018). These areas are known important habitat areas and this species is a species credit species in these areas. In areas outside important habitat, this species is considered to be an ecosystem credit species. The trees present on site provide potential forage for this species in a landscape with disconnected patches of vegetation, the loss of 35 paddock trees will reduce potential forage marginally for this species but will not impact potential breeding of this species. The Study Area (based on OEH advice) is not located in an important habitat area, and paddock trees are not recognised as important attributes to habitat for this species (OEH -Threatened species Data Collection No further survey is required.

Superb Parrot

This species was not observed during surveys. There are three main breeding areas: an area of the south-west slopes bounded by Molong, Rye Park, Yass, Coolac, Cootamundra and Young (NSW); along the Murrumbidgee River, between Wagga Wagga and Toganmain Station, and farther north at Goolgowi (NSW); and along the Murray and Edward Rivers, from east of Barmah and Millewa State

Forest to south of Taylors Bridge (NSW and Victoria) (Baker-Gabb, 2010). The Study Area is approximately 120km east from one of main breeding areas (Millewa State Forest). This species primarily feeds on the ground and prefer seed from a variety native and exotic grasses as well as shrub and tree seed and blossom. In areas outside important habitat, this species is considered to be an ecosystem credit.

Due to the current formal survey being undertaken outside the recommended survey period (for breeding), further surveys maybe required to comply with the current BAM methodology.

Major Mitchell's Cockatoo

This species was not observed during formal avifauna surveys. This species is omnivorous has the potential to be present in the locality at any time of the year due to the presences of forage such as seeds from grass, shrubs and trees (Birdlife Australia 2018).

The surveys where undertaken outside the recommend survey period (OEH 2018b) for breeding (Aug-Nov).

Amphibian

No Amphibians where recorded during formal transect or listening surveys.

All ephemeral depressions and dams on site where observed to be substantially modified. The depression has routinely been ploughed for cropping and as a result on exotic species are present, and at the time of survey had been cropped and grazed leaving only stubble. The dam within the Study Area is completely devoid of Vegetation laving exposed hard clays and the water level was low.

The lack of habitat for threatened species such as *Crinia sloanei,* severally restricts the chance of the species occurring on the site. Surveys where carried out prior to the known survey period for this species. It is unlikely that this species would utilise the current Study Area.

Microchiropterans Bats

A total of four microbat species were detected via the use of the Anabat express echo-location call recorder. No threatened species where confidently detected the species detected include: White-striped Freetail-bat (*Austronomus australis*), Chocolate Wattled Bat (*Chalinolobus morio*), Gould's Wattled Bat (*Chalinolobus gouldii*), and Little Forest Bat (*Vespadelus vulturnus*), and are all known common species.

Additionally, the following bat species had potential to occur within the study area, but could not be confidently identified:

- Ride's Free-tailed Bat (*Mormopterus ridei*);
- Inland Free-tailed Bat (*Mormopterus petersi*);
- Large-footed Myotis (*Myotis macropus*) (Listed Vulnerable BC Act)
- Lesser Long-eared Bat (*Nyctophilus geoffroyi*);
- Gould's Long-eared Bat (*Nyctophilus gouldii*);
- Inland Broad-nosed Bat (*Scoteanax balstoni*);
- Inland Forest Bat (*Vespadelus baverstocki*) (Listed Vulnerable BC Act)
- Large Forest Bat (*Vespadelus darlingtoni*); and
- Southern Forest Bat (*Vespadelus regulus*);

Refer to **Appendix B** for a detailed list of recorded species and **Appendix E** for the Anabat Call Recording reports.

6 Potential prescribed biodiversity impacts on threatened species

Occurrences of karst, caves, crevices and cliffs

There was no observed occurrences of karst, caves, crevices or cliffs within the Study Area.

Occurrences of rock

There were no observed occurrences of rock outcrops within the Study Area

Occurrences of human made structures and non-native vegetation

The current proposed development area has human made structures in the southern portion of the site and one patches of non-native vegetation that has been used as windrows.

There is a single large farm shed currently being used to store feed for stock on the property and a grain silo. These structures in-particular the shed would provide potential roosting habitat for threatened Micro-chiropterans bat species such as *Chalinolobus picatus*.

The non-native vegetation windrow consists of Pinus sp. and a non-indigenous Melaleuca species. This Windrow could provide roosting habitat for many of the highly mobile threatened bird species predicted to occur in the locality. In addition, the Pine species may provide forage for threatened cockatoo species such as the Glossy Black Cockatoo and the Major Mitchell's Cockatoo.

7 Matters of National Environmental Significance

An EPBC Act Protected Matters Search (accessed 13-03-2018) was undertaken to generate a list of those Matters of National Environmental Significance (MNES) from within 10 km of the Site. An assessment of those MNES relevant to biodiversity has been undertaken in accordance within EPBC Act Policy Statement 1.1 Significant Impact Guidelines Matters of National Environmental Significance (DoE, 2013). The Matters of National Environmental Significance protected under national environment law include:

- Listed threatened species and communities;
- Listed migratory species;
- Ramsar wetlands of international importance;
- Commonwealth marine environment;
- World heritage properties;
- National heritage places;
- The Great Barrier Reef Marine Park;
- Nuclear actions; and
- A water resource, in relation to coal seam gas development and large coal mining development.

Listed Threatened Species and Communities

A total of 25 threatened species and 5 threatened ecological communities listed under the EPBC Act have been recorded on the protected matters search. A likelihood of occurrence assessment for these MNES has been completed in **Appendix C**.

Threatened Species

Nine threatened birds, four mammals, two reptiles five fish one frog, two reptiles and one insect were recorded on the protected matters search. Of these, 6 species were considered to have the potential to utilise the habitats within the development site:

- Regent Honeyeater (*Anthochaera phrygia*)
- Painted Honeyeater (*Grantiella picta*)
- Swift Parrot (*Lathamus discolor*)
- Superb Parrot *(Polytelis swainsonii*)
- Corben's Long-eared Bat (*Nyctophilus corbeni*)
- Grey-headed Flying Fox (*Pteropus poliocephalus*)
- Koala (*Phascolarctos cinereus*)

Formal targeted surveys carried out as part of the BAM methodology, did not record any of the above species, and no habitat on the study area is critical to their survival.

This assessment concluded that the proposal is unlikely to impact the listed threatened species.

No Threatened Ecological Communities listed under the EPBC Act have been recorded within the study area.

Listed Migratory Species

The protected matters search nominated 12 migratory species or species habitat that may occur with the 10km site buffer search area. No listed migratory species were observed on site. The

assessment contained in **Appendix C** concluded that, no habitat on the study area is critical to their survival. Therefore, it is unlikely that the proposal over the study area will impact migratory species.

Wetlands of International Significance (declared Ramsar wetlands):

The site is not a wetland of international significance or declared Ramsar wetland. The protected matters search nominates the following wetlands of international importance:

- Banrock Station wetland complex

This wetland is located 500-600 km upstream from the Study Area. It supports two nationally listed species, the Vulnerable Regent Parrot and the Vulnerable Southern Bell Frog. The site provides non-breeding habitat for 10 migratory waterbirds listed under the international migratory bird treaties between Australia, China, Korea and Japan

- Barmah forest

This Forest is located 40-50 km upstream from the study area. The Forest is part of the largest complex of tree-dominated floodplain wetlands in southern Australia. Barmah Forest, together with Millewa Forests (on the New South Wales side of the Murray River) is nationally the largest continuous stand of river red gum forest.

- Gunbower forest

This Forest is located 100-150 km upstream from the study area. A total of 48 species of wetland bird have been recorded breeding within the site, which is over 70 per cent of the total wetland bird species richness for the site.

- Hattah-kulkyne lakes

These lakes are located 300-400 km upstream from the study area. The lakes are the largest series of floodplain lakes along the Murray River and the site is considered representative of a good example of a series of large, hydrologically connected, permanent and intermittent floodplain lakes. The site supports a number of migratory species, notably waterbirds and fish, with 12 waterbirds listed as migratory under the EPBC Act as well as under international migratory species treaties

- NSW Central Murray State Forests

This Forest is located 40-50 km upstream from the study area. The Forest provides a habitat network for 11 species listed in migratory bird agreements between Australia and Japan (JAMBA), Republic of Korea (ROKAMBA), and China (CAMBA).

- Riverland

This site is located 400-500 km upstream from the study area. The Riverland Ramsar site is a representative example of a major floodplain system within the Murray Scroll Belt Subregion of the Riverina Biogeographical Region of the Murray Darling Basin.

- The Coorong and Lakes Alexandrina and Albert Wetland

This wetland is located 500-600 km upstream from the study area. A significant number of waterbird species use this Ramsar site. This includes species listed under international migratory conservation agreements, as well as species where the numbers are a significant proportion of their global population.

Commonwealth Marine Areas:

The site is not part of a Commonwealth Marine Area and is not in close proximity to any such area.

World Heritage Properties:

The site is not a World Heritage area and is not in close proximity to any such area.

National Heritage Places:

The site is not a National Heritage area and is not in close proximity to any such area.

Great Barrier Reef Marine Parks:

The site is not part of or within close proximity to any Great Barrier Reef Marine Park.

Nuclear Actions:

The proposal over the site is not and does not form part of a Nuclear action.

Water Resources in relation to Coal Mining and CSG:

The proposal over the site is related to residential development and as such is not or does not form part of a coal mining and/or CSG proposal.

Summary - In summary, the proposed action is unlikely to have an impact to MNES based on the assessment criteria set out in relevant Commonwealth policies and advices as at the time of this assessment.

8 Impact Assessment

8.1 Avoid and Minimise Impacts on Biodiversity Values

Site Selection

The proposed location of the Mulwala Solar Farm was considered for the following reasons:

- Proximity to Mulwala substation to feed into the electricity grid;
- Low environmental constraints – primarily cleared agricultural lands.
- Final footprint undertaken following detailed environmental and cultural heritage assessments to reduce impacts

Design of Development Footprint

The development site footprint has undergone several redesigns to reduce impacts on biodiversity values within the original project boundary.

The proposed development footprint has avoided and minimised impacts on biodiversity values by

- Restricting development of the solar farm to within 215.15ha of cleared agricultural lands;
- Exclude all development from the ephemeral depression (exotic vegetation cover). Part of the depression has been mapped as Category two Sensitive Regulated Lands;
- Retain small cluster of *Eucalyptus macrocarpa* that are adjacent to native vegetation within the Lambruck Lane roadside;
- Exclude any development from vegetation along the south-western boundary and the western corner of the study area;
- Retain two tree windrows with native tree and shrub species located in the centre of the parcel of land;
- Avoid 31 paddock trees in redesign; and
- Retain 21 paddock trees within the development area

8.2 Avoid and Minimise Impacts on Prescribed Biodiversity Impacts

Impacts of development on the habitat of threatened species or ecological communities associated with human made structures and non-native vegetation

Human- Made structures

The southern parcel of the development site is the location of a large agricultural shed. To allow for current configuration of the Solar farm and to allow for avoidance of other biodiversity values on the site, this shed will be removed. Structures such as the shed are potential roosting habitat for the threatened bats species Little Pied Bats *Chalinolobus picatus*, although this species have not been recorded on site.

Non-native vegetation

A narrow non-native tree windrow (*Pinus* sp.), is located perpendicular to the southern boundary of the southern parcel of the project area. This vegetation may provide some roosting potential for highly mobile bird species in the locality and also foraging opportunity (pine cones) for large bird species such as Glossy Black cockatoo (*Calyptorhynchus lathami*) and Major Mitchell's Cockatoo *Lophochroa leadbeateri.* This windrow has been avoided in the final development footprint.

Impacts of development on water quality, water bodies and hydrological process that sustain threatened species and threatened ecological communities.

The northern parcel of the project an ephemeral depression was identified. The vegetation in this area is of low condition due to the it being exotic crop and pasture species. The area is known to become inundated during high rainfall (pers com. Landholder). This depression has been avoided as part of development area refinement to allow for it to be retained.

One farm dam is located within the development site. The dam is completely devoid of vegetation and at the time of survey, the water level was low. This dam provides little habitat value for threatened amphibian species such as *Crinia sloanei* Sloane's Froglet, due to the lack of vegetation present. The current configuration of the Solar farm has address a range of biodiversity values with the wider project area, which in-turn the loss of the low-quality habitat dam is unavoidable.

9 Impact Summary

The following outlines direct and indirect impacts associated with the proposal. Refer to **Figure 4** showing unavoidable impacts to paddock trees.

9.1 Direct Impacts

The construction and operation of the Mulwala Solar Farm will result in the following direct impacts:

Paddock Trees

The following paddock trees (**Table 7**) will be unavoidable be removed as part of the clearing works associated with the construction of the Solar Farm:

Table 7 Paddock tree direct impacts

Class of Paddock tree being cleared	#Paddock Trees that contain hollows	#Paddock Trees that do not contain hollows
Class 1	N/A	1
Class 2	0	2
Class 3	26	5

- Total of 34 paddock trees are to be removed

Vegetation

- 215.15 ha of cleared agricultural land that does not provide biodiversity values or generate credits

In addition to the above direct Paddock Tree impacts, the following (**Table 8**) direct impacts may arise during the construction and operation of the Mulwala Solar Farm.

Table 8 Biodiversity Direct impacts

Impact	Frequency	Duration	Consequence
Displacement of resident fauna	Initial vegetation clearing only	Construction period	▪ Mortality of native fauna ▪ Decline in local population
Removal of habitat trees	Initial vegetation clearing only	Construction period	▪ Loss of fauna habitat ▪ Decline in local fauna population
The installation of permanent structures (Solar panels, fences	On-going	On-going	▪ Reduced fauna movement across the landscape ▪ Fauna collision with security fencing ▪ Alter movements due to increased heat or solar exposure
Removal of grazing areas (exotic) for fauna	On-going	On-going	▪ Loss of forage area for terrestrial ▪ Loss of forage area for avifauna

9.2 Indirect Impacts

The construction and operation of the Mulwala Solar Farm may result in the following indirect impacts described in **Table 9**.

Table 9 Indirect biodiversity values Impacts

Impact	Frequency	Duration	Consequence
Damage/loss to adjacent roadside vegetation	Rare	Construction and operation	▪ Vegetation damages from unauthorised access ▪ Damage from authorised storage ▪ Paddock removal falling into adjacent vegetation
Loss of retained paddock trees in the development site, due to damage or impacts of surrounding infrastructure	Rare	Construction and Operation	▪ Increased fauna habitat loss ▪ Further decline in local fauna population ▪ Loss of refuge across the development site
Increased dust noise and light spill	frequent	Construction	▪ Alter fauna behaviour (breeding and roosting) in the immediate locality ▪ Dust cover may impact function of flora species in adjacent vegetation ▪ Increased light in the locality impact on nocturnal fauna movements
Introduction of pathogens that will impact retained paddock trees	Rare	On-going	▪ Mortality of paddock trees from disease ▪ Loss of fauna habitat ▪ Removal of dead tree due to safety or risk of damage to infrastructure
Increased solar exposure to adjacent vegetation or retained paddock trees from solar panels	Rare	On-going	▪ Damage/loss of adjacent vegetation ▪ Loss of paddock trees

9.3 Prescribed Biodiversity Impacts

The construction and operation of the Mulwala Solar Farm may result in the following prescribed biodiversity impacts described in **Table 10**.

Table 10 Prescribed Biodiversity Impacts

Impact	Frequency	Duration	Consequence
Removal of Farm Shed (human made structure)	Single occurrence	Construction	▪ Loss of potential roosting habitat (bats) ▪ Loss of fauna refuge
Removal of Dam	Single occurrence	Construction	▪ Loss of watering point for fauna

Figure 4 Unavoidable Impacts – Paddocks Trees

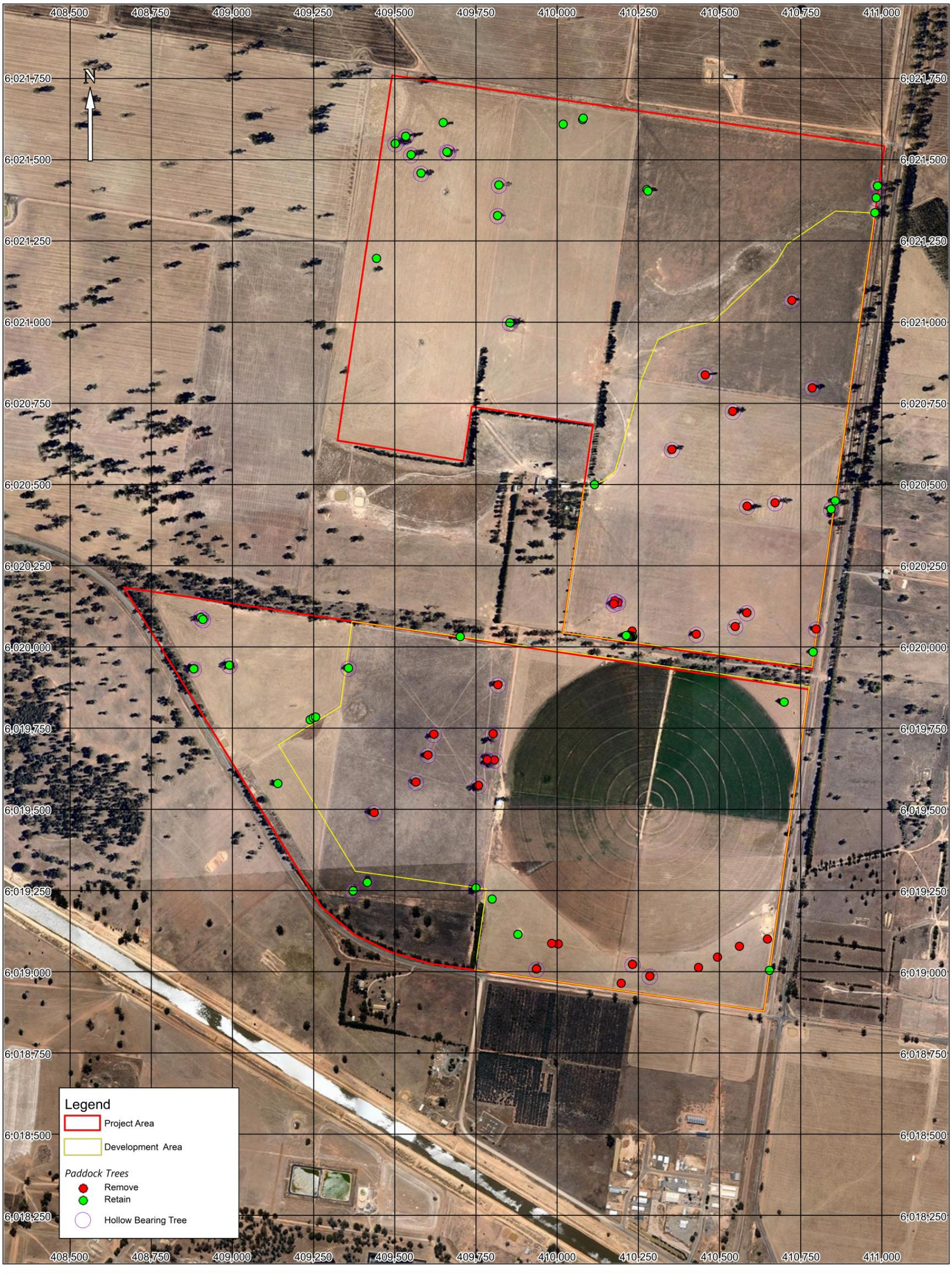


Figure 4: Unavoidable Impacts - Paddock Trees
Client: ESCO Pacific

0 500
meters
Scale 1:10,000

Datum/Projection::
GDA1994 MGA Zone 55
Date:25/5/2018
Version: 1.0

Data Source:
Aerial - Nearmap (2018)
Data: RPS & MJD Environmental (2018)

Project Files\18011 - Mulwala Solar Farm, Mulwala\5. GIS\WOR\18011_Mulwala_BDAR Figs_240518.WOR

10 Mitigation and Managing Impacts

The following section outlines general mitigation measures required to manage impacts associated with the construction and operation of the Mulwala Solar Farm. All mitigation measures propose to manage impacts that include techniques, timing, frequency and responsibility for implementing each measure.

Table 11 Mitigation Measures

Mitigation Measures	Responsibility	KPI	Timing	Corrective Action
Direct Impacts				
Pre-clearance Surveys				
Tree removal works are to occur outside assessed threatened species breeding periods (species known to breed in hollows)	Project ecologist in consultation with project manager	Works plan indicates tree clearing during optimal months	Late Summer to Winter	Cease site works, revert to KPI
Pre-clearance survey of all tree to be removed	Project Ecologist	Tree pre-clearance survey completed within a week of removal	Prior to commencement of works	Cease site works, revert to KPI
Mark habitat trees	Project Ecologist	All habitat trees flagged	Prior to commencement of woks	Cease site works, revert to KPI
Habitat Tree Removal				
Clear hollow-bearing and habitat trees remaining on Site	Contractors	Trees soft-felled or similar method used	During clearing works	Cease site works and refer to KPI and timing of activities
Felled trees left in situ before stockpiling to allow for any fauna to move on	Contractors	Trees left overnight after felling, stockpiled within clearing boundary	After felling of hollow-bearing and habitat trees, prior to stockpiling	Cease site works and refer to KPI and timing of activities
Felling supervised by Ecologist	Project Ecologist	Tree hollows checked for fauna Fauna welfare managed in accordance with ethic licencing	During clearing works	Cease site works and refer to KPI and timing of activities
Indirect Impacts				
Retained Paddock trees				
Establish Tree Protection Zones (TPZ) around retained paddock trees in development area	Contractor in consultation with project ecologist	TPZ is to 12xDBH in accordance with Australian Standards AS4970-2009 No go zone signs Fencing to include high vis bunting and star pickets	Prior to construction	Cease site works and refer to KPI
Noise and light Impacts				
Limit works to daylight hours to reduce impacts from light and noise	Construction contractor	No works to occur from dusk till dawn.	During construction works	Cease site works and refer to KPI

Mitigation Measures	Responsibility	KPI	Timing	Corrective Action
All machinery are correctly maintained and operator as per operation manual	Construction contractor	No excessive noise of machinery due to poor maintenance or faulty parts	During construction works	Cease site works and refer to KPI
Dust Impacts				
Vehicles/machinery to observe 20km/h speed limit on Site	Contractors	No excessive dust	For the duration of Site works	Reassess KPI and control measures if excessive dust continues
Usage of water carters in dry periods to limit dust movement.	Construction contractor	No excessive dust is to cover retained adjacent vegetation	During construction	Reassess KPI and control measures if excessive dust continues
Hygiene Protocol				
Equipment and vehicles entering Site are cleaned of foreign soil and seed prior to entering the site	Contractors	Best practice hygiene protocols followed, No visible foreign material, certification available upon request	Prior to machinery arriving on Site	Non-compliance due to foreign material present, Refer to KPI
Prescribed Biodiversity Impacts				
Erosion and sediment controls enacted in accordance with construction environment management plan(CEMP) to limit impacts on retained vegetation or water courses	Construction Contractor	CEMP followed & modified as needed	Prior to commencement of works, for duration of Site works	Cease site works, Refer to KPI
Pre-clearance of farm shed for fauna species	Project ecologist	Pre-clearance completed	Pre-clearance undertaken day prior to removal	Cease site works, Refer to KPI
Shed removal supervised by Ecologist	Project Ecologist	Fauna welfare managed in accordance with ethic licencing	During clearing works	Cease site works and refer to KPI and timing of activities
Temporary fencing along ephemeral depression to limit access	Construction Contractor	Fenced installed and secured	Prior to construction	Cease site works, Refer to KPI
De-watering of dam supervision by ecologist	Project Ecologist	Fauna identified and relocated to appropriate vegetation Fauna welfare managed in accordance with ethic licencing	During construction works	Cease site works and refer to KPI and timing of activities

11 Offset Calculations

The unavoidable impact of removing 34 Paddock trees for the proposed Mulwala Solar Farm will require the calculation of offset requirements for each tree. The following **Table 12** provides a breakdown of trees to be removed and credits required to offset each tree. Only Class 2 and Class 3 trees require offsets credits.

Table 12 Paddock Tree Offset Calculation

Class of Paddock tree being cleared	#Paddock Trees that contain hollows (Credit)	Paddock Trees that do not contain hollows (Credit)
Class 2	0 (x 0.75)	2 (x 0.5)
Class 3	26 (x 1)	5 (x 0.75)

A total of **30.75 ecosystem credits** are required to offset the loss of **33 paddock trees**.

The following credit profiles (**Table 13**) have been generated for the three PCTs of which the removed paddocks species are dominant species.

Table 13 Ecosystem Credit Profile

Attributes	PCT -75	PCT -76	PCT -80
Name of PCT impacted by development	Yellow Box - White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and western NSW South Western Slopes Bioregion	Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion
Name of CEEC or EEC VEC associated with PCT	BC Act: Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions BC Act: White Box Yellow Box Blakely's Red Gum Woodland EPBC Act: White Box Yellow Box Blakely's Red Gum Woodland	BC Act: Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EPBC Act: Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions	BC Act: Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions BC Act: Mallee and Mallee-Broombush dominated woodland and shrubland, lacking Triodia, in the NSW South Western Slopes Bioregion EPBC Act: Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar

Attributes	PCT -75	PCT -76	PCT -80
			and Brigalow Belt South Bioregions
Name of offset trading group	Tier 1 or 2	Tier 2 or 3	Tier 1, 3 or 4
Vegetation Class	Riverine Sandhill Woodlands	Floodplain Transition Woodlands	Floodplain Transition Woodlands
Vegetation formation	KF_CH11B Semi-arid Woodlands (Shrubby sub-formation)	KF_CH3 Grassy Woodlands	KF_CH3 Grassy Woodlands
Presences or absences of hollowing baring trees	Yes	Yes	Yes
IBRA Sub-region	Murray fans	Murray fans	Murray fans

12 Conclusion

MJD Environmental Pty Limited has been engaged by RPS Group C/O- ESCO Pacific to prepare a Biodiversity Development Assessment Report (BDAR) for the construction and operation of the Mulwala Solar Farm, Mulwala, NSW.

The Biodiversity Development Assessment Report has been prepared as part of an Environmental Impact Statement (EIS) for the SSD of the Mulwala Solar Farm and aims to address the Secretary's Environmental Assessment Requirements (SEARs) issued on 5 February 2018.

In addition, preliminary assessment was also undertaken having regard to those threatened entities listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Based on assessment of the BAM 2017 and consultation with the NSW OEH, the site has been determined to qualify for a Streamlined (Paddock Tree) Assessment. As such the methodology, assessment and BDAR adheres to the BAM 2017 for Streamlined (Paddock Tree) Assessment.

Impact Avoidance & Mitigation

A package of avoidance and mitigation measures have been described in this BDAR associated with the project. These measures have been incorporated into the design (avoidance) in the first instance with mitigation measures assessed for the construction and operational phases of the project.

Impact Analysis

The proposal will result in the removal of 34 Paddock Trees of which 33 require ecosystem credits. In accordance with the BAM (2017), a total of 30.75 ecosystem credits are required to offset the loss.

A preliminary assessment under the EPBC Act determined the proposed action is unlikely to have an impact to MNES based on the assessment criteria set out in relevant Commonwealth policies and advices as at the time of this assessment.

13 Bibliography

Baker-Gabb D (2011). National Recovery Plan for the Superb Parrot Polytelis swainsonii. Department of Sustainability and Environment, Melbourne

Birdlife Australia (2018) Birdline Victoria and NSW: Bird distribution mapping of rare and threatened bird species http://www.eremaea.com/BirdlineRecentSightings.aspx?Birdline=1 (Accessed May 2018)

Botanical Gardens Trust 2017 -*Plantnet*- The Plant Information Network System of The Botanic Gardens Trust, Sydney, Australia. Accessed October 2017.

Commonwealth of Australia (2016) *National Recovery Plan for the Regent Honeyeater (Anthochaera phrygia)*. Canberra, ACT: Department of Environment. In effect under the EPBC Act from 04-May-2016 as Anthochaera Phrygia

Cropper (1993) *Management of Endangered Plants*. CSIRO Publications, East Melbourne, Victoria

Department of the Environment and Energy (2018a): *Commonwealth Biodiversity: Species Profile and Threats Database (SPRAT)* - http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl (accessed May 2017)

Department of the Environment and Energy (2018b); *Flying Fox Monitoring Viewer* *http://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf* (Accessed May 2018)

Department of Environment and Conservation (2006b) Recovery Plan for the Large Forest Owls: Powerful Owl (Ninox strenua), Sooty Owl (Tyto tenebricosa) and Masked Owl (Tyto novaehollandiae). Department of Environment and Conservation, Sydney.

eBird (n.d.) Species maps database (amateur sightings uploaded to an interactive map). https://ebird.org/map/

Harden, G.J. (Ed) (1992) *Flora of New South Wales. Volume 3.* Royal Botanical Gardens Sydney & New South Wales University Press, Sydney

Harden, G.J. (Ed) (1993) *Flora of New South Wales. Volume 4.* Royal Botanical Gardens Sydney & New South Wales University Press, Sydney

Harden, G.J. (Ed) (2000) *Flora of New South Wales. Volume 1.* Royal Botanical Gardens Sydney & New South Wales University Press, Sydney

Harden, G.J. (Ed) (2002) *Flora of New South Wales. Volume 2.* Royal Botanical Gardens Sydney & New South Wales University Press, Sydney

NSW OEH (2018a) BioNet Vegetation Information System: Classification Database. Accessed online at http://www.environment.nsw.gov.au/research/Visclassification.ht (Accessed April and May 2018)

NSW OEH (2018b) NSW Bionet. Accessed online – http://www.bionet.nsw.gov.au/

NSW OEH (2018) Threatened Species Profile Search - http://www.environment.nsw.gov.au/threatenedSpeciesApp/ (accessed May 2018)

NSW OEH (2017a) Biodiversity Assessment Methodology (BAM). Office of Environment and Heritage for the NSW Government, Sydney, NSW.

NSW OEH (2017b) Guidance to assist a decision-maker to determine a serious and irreversible impact, NSW Government

Thackway. R., Cresswell. I.D. (1995) *An Interim Biogeographic Regionalisation for Australia.* Reserve Systems Unit, Australian nature Conservation Agency

Pizzey, G. and Knight, F. (2007) *The Field Guide to the Birds of Australia*. Harper Collins Publishers, Sydney.

Robinson, M. (1998) *A field Guide to Frogs of Australia*. Reed New Holland, Sydney.

Strahan, R. (2004) *The Mammals of Australia*. New Holland Publishers, Australia.

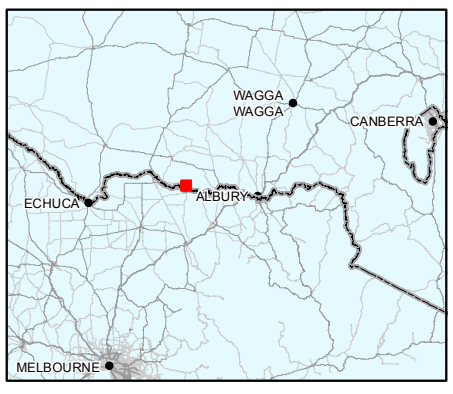
Simpson. K, and Day. N. (2010) *Field Guide to the Birds of Australia*. Penguin Group, Australia.

Strahan, R. (2004) *The Mammals of Australia*. New Holland Publishers, Australia.

Tyler, M. J. And Knight. F. (2011) *Field Guide to the Frogs of Australia*. Revised Edition. CSIRO Publishing, Australia.

Walsh, N.G. and Entwisle, T.J. 1996. Flora of Victoria Volume 3: Winteraceae to Myrtaceae. Inkata Press, Melbourne

Appendix A Plan of Proposal



N

0 170 340 510

Meters

APPROX SCALE 10,000 @ A3
GDA 1994 MGA Zone 55

Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use. Development Footprint area for indicative purposes only.

DATA SOURCES
Road network provided by Department of Environment, Land, Water and Planning (DELWP) Web Map Service.
Watercourse data provided by DELWP 2018.
Imagery from Esri basemap layer.

LEGEND

- Project Boundary
- Development Footprint April
- Development Footprint May Update
- Waterbody
- Watercourse
- Cadastre

RPS

Project Area
Mulwala Solar Farm Project

Tracking ID: W:\Jobs\PR137229-1 RPS Melbourne - Mapping Support Services GIS\Working\Job_18037_Mulwala_Solar_Farm\Working\Project_Area_Mulwala_Solar_Farm_A3P.mxd
Compiled: 15 May 2018

Appendix B Flora and Fauna Species List

Scientific Name	Common Name	Tree Windrow #1	Tree Windrow #2	Exotic Pasture	Paddock Tree
Asteraceae					
*Cirsium vulgare**	Spear Thistle			x	
*Xanthium spinosum**	Bathurst Burr			x	
Boraginaceae					
*Echium plantagineum**	Paterson's Curse			x	
*Heliotropium europaeum**	European Heliotrope			x	
Casuarianceae					
Allocasuarina luehmannii	Bulloke				x
Chenopodaceae					
Atriplex nummularia			x		
*Chenopodium murale**	Nettle-leaved Goosefoot	x	x	x	
Cucurbitaceae					
*Citrullus colocynthis**	Bitter Apple			x	
Cupressaceae					
Callitris glaucaphylla	White Cypress				x
Cyperaceae					
Juncus usitatus				x	
Lamiaceae					
*Marrubium vulgare**	Horehound	x	x	x	
Mimosaceae					
Acacia decora			x		
Myrtaceae					
Eucalyptus albens	White Box				x
Eucalyptus camaldulensis	River Red Gum		x		x
Eucalyptus melliodora	Yellow Box		x		x
Eucalyptus microcarpa	Grey Box		x		x
Eucalyptus sideroxylon					
Melaleuca sp.#		x			
Pinaceae					
Pinus sp.*		x			
Poaceae					
*Agrostis capillaris**	Brown-top Bent		x	x	
*Avena sativa**	Wild Oats			x	
Chloris truncata	Windmill Grass	x	x	x	
Cynodon dactylon	Couch		x	x	
*Eragrostis curvula**	African Love grass			x	
*Hordeum leporinum**	*Barley Grass*			x	
*Lolium perenne**	Rye-grass			x	
Panicum effusum	Hairy Panic			x	
*Triticum aestivum **	Wheat			x	

*Exotic, #Non-local native

Fauna List	
Birds	
Apostlebird	*Struthidea cinerea*
Australian Magpie	*Cracticus tibicen*
Australian Pipit	*Anthus novaeseelandiae*
Australian Raven	*Corvus coronoides*
Banded Lapwing	*Vanellus tricolor*
Blue-faced Honeyeater	*Entomyzon cyanotis*
Brown Goshawk	*Accipiter fasciatus*
Brown Thornbill	*Brown Thornbill*
Buff-rumped Thornbill	*Acanthiza reguloides*
Common Starling	*Sturnus vulgaris*
Eastern Rosella	*Platycercus eximius*
Flame Robin	*Petroica phoenicea*
Grey-crowned babbler*	*Pomatostomus temporalis*
Nankeen Kestrel	*Falco cenchroides*
Laughing Kookaburra	*Dacelo novaeguineae*
Little Corella	*Cacatua sanguinea*
Magpie Lark	*Acanthiza pusilla*
Noisy Miner	*Manorina melanocephala*
Peregrine Falcon	*Falco peregrinus*
Rainbow Lorikeet	*Trichoglossus moluccanus*
Red Rumped Parrot	*Psephotus haematonotus*
Swamp Harrier	*Circus approximans*
Wedge-tailed Eagle	*Aquila audax*
Welcome Swallow	*Hirundo neoxena*
Willie Wagtail	*Rhipidura leucophrys*
Yellow-crested Cockatoo	*Cacatua sulphurea*
Mammals	
Cattle	*Bos taurus*
Sheep	*Ovis aries*
Eastern Grey Kangaroo	*Macropus giganteus*
European Fox	*Vulpus vulpus*
European Hare	*Lepus europaeus*
White-striped Freetail-bat	*Austronomus australis*
Chocolate Wattled Bat	*Chalinolobus morio*
Gould's Wattled Bat	*Chalinolobus gouldii*
Little Forest Bat	*Vespadelus vulturnus*

Appendix C EPBC Likelihood of Occurrence Table

EPBC Likelihood of Occurrence Table

Scientific Name	Common Name	Status	Habitat requirement	Habitat present on development site
Birds				
Anthochaera phrygia	Regent Honeyeater	Critically Endangered	The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River She-Oak. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. Its primary diet consists of nectar, but also includes invertebrates. Key nectar producing trees include Yellow Box, White Box both occurring as scattered paddocks with the Study Area. In the last 10 years Regent Honeyeaters have been recorded in urban areas around Albury where woodlands tree species such as Mugga Ironbark and Yellow Box were planted 20 years ago (OEH 18). Paddock trees are not indicated as important habitat attributes for Regent Honeyeaters as per the OEH Threatened Species Data Collection. The Site is also located outside important habitat areas (breeding areas) that have been developed by OEH	Likely minor foraging habitat
Botaurus poiciloptilus	Australasian Bittern	Endangered	Inhabits dense tall sedge vegetation and permanent wetlands. No suitable habitat occurs within the study area.	Unlikely
Calidris ferruginea	Curlew Sandpiper	Critically Endangered & Migratory	Inhabits intertidal mud flats in estuaries, bays, lakes and lagoons or areas of bare mud or sand on which to forage. No suitable habitat occurs within the study area.	Unlikely
Grantiella picta	Painted Honeyeater	Vulnerable	Inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and Box-Gum Woodlands and Box-Ironbark Forests. The study area comprises scattered	Likely

			paddock trees of Eucalypt species associated with Box-Gum Woodlands in the Riverina area, therefore potential foraging habitat occurs on site.	
Lathamus discolor	Swift Parrot	Critically Endangered	Migrates to the Australian south-east mainland between March and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there is abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Commonly used lerp infested trees include Inland Grey Box *E. microcarpa*, Grey Box *E. moluccana* and Blackbutt *E. pilularis*. Paddock trees are considered to be important habitat for this species.	likely foraging habitat
Numenius madagascariensis	Eastern Curlew	Critically Endangered & Migratory	Inhabits intertidal mud flats in estuaries, bays, lakes and lagoons. No suitable habitat occurs within the study area.	Unlikely
Pedionomus torquatus	Plains-wanderer	Critically Endangered	Inhabits semi-arid, lowland native grasslands that typically occur on hard red-brown soils. Preferred habitat typically comprises 50% bare ground, 10% fallen litter, and 40% herbs, forbs and grasses. Most of the grassland habitat for this species is <5 cm high, but some vegetation up to a maximum of 30 cm is important for concealment, as long as grass tussocks are spaced 10-20 cm apart. The vegetation within the Study Area has undergone substantial modification and degradation with routine cropping, and regular grazing known to have occur on the site for the past 50 years (pers com -Landholder). Evidence of cropping was observed in the form of cultivation lines in the soils throughout the Study Area. It is unlikely this species would persist in the study area due to the lack of suitable habitat.	Unlikely
Polytelis swainsonii	Superb Parrot	Vulnerable	In the Riverina the birds nest in the hollows of large trees (dead or alive) mainly in tall riparian River Red Gum Forest or Woodland. On the South West Slopes nest trees can be in open Box-Gum Woodland or isolated paddock trees. Species known to be used are Blakely's Red Gum, Yellow Box, Apple Box and Red Box. Paddock Trees are considered to be important nesting habitat, only *E. blakelyi, E. melliodora, E. albens, E. camaldulensis, E. microcarpa & E. polyanthemos*	Likely

Rostratula australis	Australian Painted Snipe	Endangered	Inhabits floodplain wetlands of major coastal rivers, minor flood plain, coastal sandplain wetlands and estuaries. No suitable habitat occurs within the study area.	Unlikely
Herpetofauna				
Litoria raniformis	Southern Bell Frog	Vulnerable	Usually found in or around permanent or ephemeral Black Box/Lignum/Nitre Goosefoot swamps, Lignum/Typha swamps and River Red Gum swamps or billabongs along floodplains and river valleys. No suitable habitat occurs within the study area.	Unlikely
Insects				
Synemon plana	Golden Sun Moth	Critically Endangered	Occurs in Natural Temperate Grasslands and grassy Box-Gum Woodlands in which the groundlayer is dominated by wallaby grasses *Austrodanthonia* spp. The study area is mostly comprised of an exotic groundlayer. The study area is located outside of this species geographic distribution.	Unlikely
Mammals				
Nyctophilus corbeni	Corben's Long-eared Bat	Vulnerable	Inhabits a variety of vegetation types, including mallee, bulloke *Allocasuarina leuhmanni* and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. The study area comprises scattered paddock trees of such species containing hollows, therefore potential roosting habitat occurs on site.	Likely
Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia,	Likely foraging habitat only

			and fruits of rainforest trees and vines. There were no obvious signs of a permanent or seasonal roosting camps within the Study Area, indicating that this species is unlikely to use the Study area for breeding. And is more likely to use the area for periodic foraging. A search of the DoEE Flying fox monitoring viewer (DoEE 2018), which collates data from annual surveys (three per year), show that closest camp to the Study Area is approximately 52km south west in Numurkah and 83km east in Albury.	
Petauroides volans	Greater Glider	Vulnerable	Inhabits and is restricted to eucalypt forests and woodlands. This species favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species. It is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows. The study area comprises sparse paddock trees of some eucalypt species however no continuous stretch of vegetated forest and woodlands are present. The study area is located outside of this species geographic distribution.	Unlikely
Phascolarctos cinereus	Koala	Vulnerable	Inhabit eucalypt woodlands and forests in a fragmented distribution throughout eastern Australia. In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range but have been recorded in the southern tablelands. This species feeds on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Spend most of their time in trees but will descend and traverse open ground to move between trees. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size. Paddock trees are considered important habitat for this species.	Likely

Plants				
Amphibromus fluitans	River Swamp Wallaby-grass	Vulnerable	Grows mostly in permanent swamps. The species needs wetlands which are at least moderately fertile, and which have some bare ground, conditions which are produced by seasonally-fluctuating water levels. No suitable habitat occurs within the study area.	Unlikely
Austrostipa wakoolica	Spear-grass	Endangered	Confined to the floodplains of the Murray River tributaries of central-western and south-western NSW in open woodland on grey, silty clay or sandy loam soils. Associated species include; *Callitris glaucophylla, Eucalyptus microcarpa, E. populnea, Austrostipa eremophila, A. drummondii, Austrodanthonia eriantha* and *Einadia nutans*. Although some of the associated canopy species are present within the study area, vegetation has undergone substantial modification and degradation with routine cropping, and regular grazing known to have occur on the site for the past 50 years (pers com -Landholder). Evidence of cropping was observed in the form of cultivation lines in the soils throughout the Study Area. The substantial modification of groundcover and top soils within the Study area would severely restrict the occurrence of this presence, therefore no further assessment is required.	Unlikely
Brachyscome muelleroides	Claypan Daisy	Vulnerable	Grows in damp areas on the margins of claypans in moist grassland with *Pycnosorus globosus, Agrostis avenacea* and *Austrodanthonia duttoniana*. Victorian collections have generally come from open positions on the Murray River floodplain, swampy River Red Gum (*Eucalyptus camaldulensis*) Forest and damp depressions. No suitable habitat is present within the study area.	Unlikely

Caladenia tensa	Greencomb Spider-orchid	Endangered	The rigid spider-orchid occurs in *Callitris* spp. (cypress pine), *Eucalyptus leucoxylon* (yellow gum) woodland and *Melaleuca uncinata* (broombush) mallee on Tertiary and Quaternary aeolian sandy loams in the Murray-Darling Depression bioregion. The study area is located outside of this species known geographic distribution.	Unlikely
Pimelea spinescens subsp. spinescens	Plains Rice-flower	Critically Endangered	This species associates with *Eucalyptus leucoxylon* (yellow gum) and *E. microcarpa* (grey box) grassy woodland, and *Allocasuarina luehmannii* (Buloke) open grassy. The species occurs in grassland or open shrubland, usually developed on clay soils. This species is endemic to Victoria where it occurs in the central west of the state (Walsh & Entwisle 1996). The study area is located outside of this species known geographic distribution. The substantial modification of groundcover and top soils within the Study area would severely restrict the occurrence of this presence, therefore no further assessment is required.	Unlikely
Prasophyllum validum	Sturdy Leek-orchid	Vulnerable	This species occurs in drier woodland habitats, generally with a low sparse understorey. This species occurs in box and box-ironbark woodland. Associated species include *Eucalyptus polyanthemos*, *Eucalyptus albens, Eucalyptus macrorhyncha, Eucalyptus viminalis* and *Callitris glaucophylla*, and an open grassy to sparsely shrubby understorey including *Themeda triandra, Joycea pallida, Arthropodium strictum, Acacia verniciflua, Bursaria spinosa, Grevillea alpina* and *Grevillea dryophylla.* The study area is located outside of this species geographic distribution.	Unlikely
Sclerolaena napiformis	Turnip Copperburr	Endangered	Confined to remnant grassland habitats on clay-loam soils. Grows on level plains in tussock grassland of *Austrostipa nodosa* and *Chloris truncata*, in grey cracking clay to red-brown loamy clay. This species is restricted in NSW to the Jerilderie area in the South Western Plains botanical subdivision. .	Unlikely

			The substantial modification of groundcover and top soils within the Study area and the restrict distribution of this species would severely restrict the occurrence of this species.	
Swainsona murrayana	Slender Darling-pea	Endangered	The species has been collected from clay-based soils, ranging from grey, red and brown cracking clays to red-brown earths and loams. Grows in a variety of vegetation types including bladder saltbush, black box and grassland communities on level plains, floodplains and depressions and is often found with Maireana species. Plants have been found in remnant native grasslands or grassy woodlands that have been intermittently grazed or cultivated. The substantial modification of groundcover and top soils within the Study area would severely restrict the occurrence of this presence, therefore no further assessment is required.	Unlikely
Reptiles				
Aprasia parapulchella	Pink-tailed Legless-Lizard	Vulnerable	Inhabits sloping, open woodland areas with predominantly native grassy groundlayers, particularly those dominated by Kangaroo Grass (*Themeda australis*). Sites are typically well-drained, with rocky outcrops or scattered, partially-buried rocks. The study area comprises mostly of an exotic understorey with no T. australis. The study area is characterised by cropped and grazed paddocks with no rocky outcrops. No suitable habitat occurs within the study area.	Unlikely
Delma impar	Striped Legless Lizard	Vulnerable	Found mainly in Natural Temperate Grassland but has also been captured in grasslands that have a high exotic component. Also found in secondary grassland near Natural Temperate Grassland and occasionally in open Box-Gum Woodland. Associated habitat grasses include; Kangaroo Grass *Themeda australis*, spear-grasses *Austrostipa* spp. and poa tussocks *Poa* spp., and occasionally wallaby grasses *Austrodanthonia* spp. Sometimes present in modified grasslands with a significant content of exotic grasses. Although known to inhabit exotic grass,the Study Areas vegetation and soil substrate has undergone substantial modification and degradation with routine cropping, and regular grazing known to have occur on the site for the past 50 years (pers com -	Unlikely

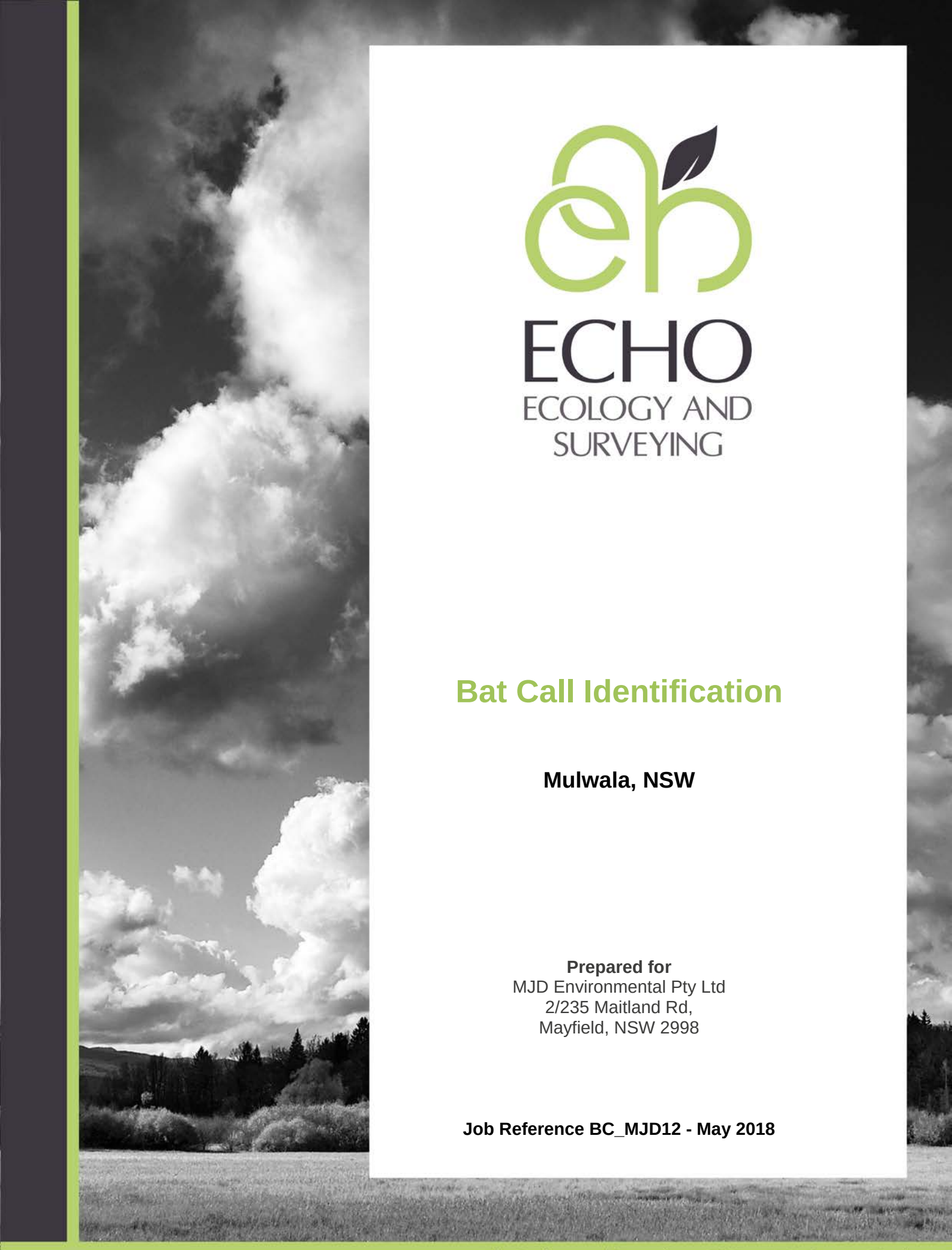
			Landholder). Evidence of cropping was observed in the form of cultivation lines in the soils throughout the Study Area The substantial modification of groundcover and top soils within the Study area would severely restrict the occurrence of this presence, therefore no further assessment is required.	
Migratory Species				
Hirundapus caudacutus	White-throated Needletail		Inhabits airspace over forests, woodlands, farmlands, plains, lakes, coasts. Feeding companies regularly patrol back and forward along favoured hilltops and timbered ranges. An individual could fly over the site between foraging grounds, however it is unlikely to forage over the site given the poor habitat offerings. No suitable habitat occurs within the study area.	Unlikely
Motacilla flava	Yellow Wagtail		Inhabits damp or wet habitats, however has been known to forage in pasture and hay fields. The study area is located outside of this species geographic distribution, this coupled with sub-optimal habitat it is considered unlikely for this species to occur within the study area.	Unlikely
Myiagra cyanoleuca	Satin Flycatcher		Inhabits heavily vegetated gullies in forests, taller woodlands and coastal forests. No suitable habitat (foraging and breeding) occurs within the study area.	Unlikely
Rhipidura rufifrons	Rufous Fantail		Inhabits undergrowth of rainforest/wetter eucalypt forests/gullies; monsoon forests, paperbarks, coastal scrubs, mangroves and watercourses. No suitable habitat occurs within the study area.	Unlikely
Wetland Species				

Actitis hypoleucos	Common Sandpiper		Inhabits shallow, pebbly, muddy or sandy edges of rivers and streams, coastal to far inland; dam, lakes, sewage ponds, margins of tidal rivers; waterways in mangroves or saltmarsh and mudflats. No suitable occurs within the study area.	Unlikely
Calidris acuminata	Sharp-tailed Sandpiper		Inhabits tidal mudflats, saltmarshes, mangroves; shallow fresh, brackish or saline inland wetlands; floodwaters, irrigated pastures and crops. No suitable habitat occurs within the study area.	Unlikely
Calidris melanotos	Pectoral Sandpiper		Inhabits shallow fresh water, often with low grass or other herbage; swamp margins, flooded pastures, sewage ponds, occasionally tidal areas and saltmarshes. No suitable habitat occurs within the study area.	Unlikely
Gallinago hardwickii	Latham's Snipe		Inhabits soft wet ground or shallow water with tussocks and other green or dead growth; wet parts of paddocks; seepage below dams. The drainage area within the study area is primarily dry with very few wet periods of inundation. No suitable habitat occurs within the study area.	Unlikely
Pandion haliaetus	Osprey		Inhabits coastal areas and extensive areas of fresh, brackish or saline water for foraging. Potential foraging grounds occur nearby at Lake Mulwala, as such an individual could fly over the site between foraging grounds, however it is unlikely to forage over the site given the poor habitat offerings. The site does not contain preferred breeding habitat. No suitable habitat (foraging and breeding) occurs on site.	Unlikely
Tringa nebularia	Common Greenshank		Inhabits coastal environments and river estuaries where muddy/ mudflat areas occur. It is also known to occur on wetlands and swamps. No suitable habitat (foraging and breeding) occurs on site.	Unlikely

Appendix D Personnel Qualifications

Name	Title	Qualifications	Roles
Matt Doherty	Director	▪ BAM Assessor (#BAAS17044) ▪ B. Landscape Management and Conservation (Soil and Water Management) ▪ Bush Regeneration Cert IV	Review and approval of BDAR. Overarching guidance of BAM assessment and BDAR development.
Adam Cavallaro	Senior Ecologist	▪ BAM Assessor (#BAAS18056) ▪ B. Environmental Science (Conservation Ecology) ▪ Bush Regeneration Cert IV	Undertake BAM assessment and BDAR. Approval of BDAR. Field work including PCT identification, vegetation mapping, and threatened flora surveys. Writing of BDAR and preparation of mapping
Phoebe Smith	Field Ecologist	▪ B. Environmental Science and Management (Honours) ▪ Master Environmental Management & Sustainability	Field work including threatened flora and fauna surveys, assisting with vegetation assessment.

Appendix E Anabat Report



ECHO
ECOLOGY AND SURVEYING

Bat Call Identification

Mulwala, NSW

Prepared for
MJD Environmental Pty Ltd
2/235 Maitland Rd,
Mayfield, NSW 2998

Job Reference BC_MJD12 - May 2018

Echo Ecology and Surveying • PO Box 4132 Crescent Head
Ecology - 0423 801 779 • **Surveying** - 0418 604 460 • **E:** info@echoecology.com.au • **W:** echoecology.com.au

This report has been prepared to document the analysis of digital ultrasonic bat echolocation calls received from a third party. The data was not collected by the author and as such no responsibility is taken for the quality of data collection or for the suitability of its subsequent use.

This report was authored by

Dr Anna McConville
PhD, B.Env.Sc.

Contents

List of Tables

List of Figures

1.0 INTRODUCTION

This report has been commissioned by MJD Environmental to analyse bat echolocation call data (Anabat, Titley Electronics) collected from Mulwala, NSW. Data was provided electronically to the author. This report documents the methods involved in analysing bat call data and the results obtained only.

2.0 METHODS

The identification of bat echolocation calls recorded during surveys was undertaken using AnalookW (Chris Corben, Version 4.2n) software. The calls appeared were recorded using Data Division Ratio 8. The identification of calls was undertaken with reference to Pennay et al. (2004) and through the comparison of recorded reference calls from the Riverina. Reference calls were obtained from the NSW database and from the authors personal collection.

Each call sequence ('pass') was assigned to one of five categories, according to the confidence with which an identification could be made, being:

- Definite - Pass identified to species level and could not be confused with another species
- Probable - Pass identified to species level and there is a low chance of confusion with another species
- Possible - Pass identified to species level but short duration or poor quality of the pass increases the chance of confusion with another species
- Species group - Pass could not be identified to species level and could belong to one of two or more species. Occurs more frequently when passes are short or of poor quality
- Unknown - Either background 'noise' files or passes by bats which are too short and/or of poor quality to confidently identify.

Call sequences that were less than three pulses in length were not analysed and were assigned to 'Unknown' and only search phase calls were analysed. Furthermore, some species are difficult to differentiate using bat call analysis due to overlapping call frequencies and similar shape of plotted calls and in these cases calls were assigned to species groups.

The total number of passes (call sequences) per unit per night was tallied to give an index of activity.

It should be noted that the activity levels recorded at different sites may not be readily able to be compared. Activity levels should not be compared among species as different species have different detectability due to factors such as call loudness, foraging strategy and call identifying features. Activity comparisons among sites are dependent on many variables which need to be carefully controlled during data collection and statistically analysed. Influential variables include wind, rain, temperature, duration of recording, season, detector and microphone sensitivity, detector placement, weather protection devices etc.

Nomenclature follows the Australian Chiroptera taxonomic list described by Reardon et al. (2015).

2.1 Characteristics Used to Differentiate Species

Chalinolobus morio calls were differentiated from those of *Vespadelus* sp. by the presence of a down-sweeping tail on the majority of pulses and a lower characteristic frequency than *Vespadelus regulus*. *Vespadelus vulturnus* was differentiated at higher characteristic frequencies by upsweeping tails on the majority of pulses.

Calls from *Mormopterus* spp. were differentiated by the presence of mainly flat pulses. Calls from *Mormopterus planiceps* were distinguished from *Mormopterus ridei* only where they do not overlap in characteristic frequency.

Chalinolobus gouldii was differentiated from other species by the presence of curved, alternating call pulses.

Myotis macropus, *Nyctophilus geoffroyi* and *Nyctophilus gouldi* were unable to be differentiated.

Austronomus australis was differentiated from other bat species on the basis of characteristic frequency.

3.0 RESULTS

A total of 11,966 call sequences were recorded, of which 554 call sequences were able to be analysed (ie were not ‘noise’ files or bat calls of short length). Of the bat calls, 164 call sequences (30 %) were able to be confidently identified (those classified as either definite

or probable identifications) to species level (Table 3-1). Species recorded confidently within the site include:

- *Austronomus australis* (White-striped Free-tailed Bat)
- *Chalinolobus gouldii* (Gould's Wattled Bat)
- *Chalinolobus morio* (Chocolate Wattled Bat)
- *Mormopterus planiceps* (Southern Free-tailed Bat)
- *Vespadelus vulturnus* (Little Forest Bat)

Additionally, the following bat species potentially occurred within the site, but could not be confidently identified (those calls classified as possible or as a species group):

- *Mormopterus ridei* (Ride's Free-tailed Bat)
- *Mormopterus petersi* (Inland Free-tailed Bat)
- *Myotis macropus* (Large-footed Myotis)
- *Nyctophilus geoffroyi* (Lesser long-eared bat)
- *Nyctophilus gouldi* (Gould's long-eared bat)
- *Scotorepens balstoni* (Inland Broad-nosed Bat)
- *Vespadelus baverstocki* (Inland Forest Bat)
- *Vespadelus darlingtoni* (Large Forest Bat)
- *Vespadelus regulus* (Southern Forest Bat)

It should be noted that additional bat species may be present within the site but were not recorded by the detectors (or are difficult to identify by bat call) and habitat assessment should be used in conjunction with these results to determine the likelihood of occurrence of other bat species.

Table 3-1 below summarises the results of the bat call analysis.

Table 3-1: Results of bat call analysis (number of passes per site per night)

IDENTIFICATION	AB1 16/04/2018	AB1 17/04/2018	AB2 16/04/2018	AB2 17/04/2018
DEFINITE				
Austronomus australis	65	2	-	-
Chalinolobus gouldii	4	10	-	-
Chalinolobus morio	-	1	-	-
Mormopterus planiceps	1	4	-	-
Vespadelus vulturnus	1	4	-	-
PROBABLE				
Austronomus australis	1	-	-	-
Chalinolobus gouldii	33	12	13	-
Chalinolobus morio	1	-	-	-
Mormopterus planiceps	10	-	2	-
POSSIBLE				
Austronomus australis	1	-	-	-
Vespadelus darlingtoni	-	1	-	-
SPECIES GROUPS				
Chalinolobus gouldii / Mormopterus petersi / Scotorepens balstoni	3	5	-	-
Chalinolobus gouldii / Mormopterus planiceps	105	13	30	1
Chalinolobus gouldii / Mormopterus ridei / Mormopterus planiceps / Scotorepens balstoni	144	13	1	1
Chalinolobus gouldii / Scotorepens balstoni	24	9	1	-
Chalinolobus morio / Vespadelus regulus	1	4	-	2
Chalinolobus morio / Vespadelus vulturnus	6	4	-	-
Chalinolobus morio / Vespadelus vulturnus / Vespadelus regulus	-	-	-	6

IDENTIFICATION	AB1 16/04/2018	AB1 17/04/2018	AB2 16/04/2018	AB2 17/04/2018
Mormopterus petersi / Mormopterus planiceps	-	1	-	-
Mormopterus ridei / Mormopterus planiceps	1	-	-	-
Myotis macropus / Nyctophilus geoffroyi / Nyctophilus gouldi	1	-	-	-
Vespadelus baverstocki / Vespadelus darlingtoni / Vespadelus vulturnus	1	1	-	-
Vespadelus baverstocki / Vespadelus vulturnus	7	3	-	-
UNKNOWN				
'Noise' files	2	7	7701	3551
Unknown	98	8	29	16
TOTAL	**510**	**102**	**7777**	**3577**

4.0 SAMPLE CALLS

A sample of the calls actually identified from the site for each species is given below.

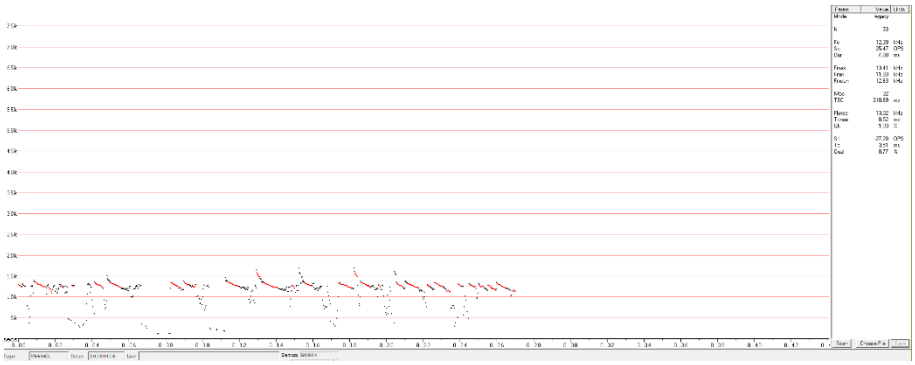


Figure 4-1: *Austronomus australis* definite call

Figure 4-2: *Chalinolobus gouldii* definite call

Figure 4-3: *Chalinolobus morio* definite call

Figure 4-4: *Mormopterus planiceps* definite call

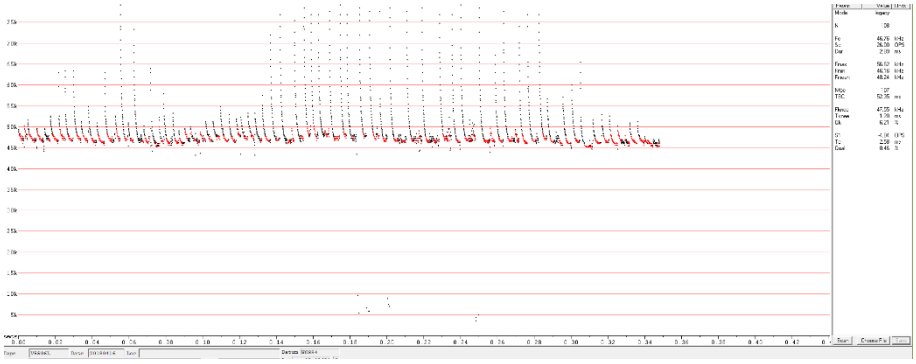


Figure 4-5: *Vespadelus vulturnus* definite call

5.0 REFERENCES

Adams, M. D., Law, B.S., French, K.O. (2009). "Vegetation structure influences the vertical stratification of open- and edge-space aerial-foraging bats in harvested forests." Forest Ecology and Management 258(9): 2090-2100.

Adams, M. D., Law, B.S., French, K.O. (2010). Reliable automation of bat call identification for eastern New South Wales, Australia, using classification trees and AnaScheme software. *Acta Chiropterologica* 12(1): 231-245.

Australasian Bat Society Incorporated (undated) *Standards for reporting bat detector surveys*, http://batcall.csu.edu.au/abs/issues/ABS_Anabat_survey_standards.pdf

Churchill, S. (2008). *Australian Bats.* Second Edition Allen & Unwin; Crows Nest, NSW.

Law, B.S., Reinhold, L. and Pennay, M. (2002). Geographic variation in the echolocation calls of Vespadelus spp. (Vespertilionidae) from New South Wale and Queensland, Australia. *Acta Chiropterologica* 4: 201-215.

Pennay, M., Law, B. and Reinhold, L. (2004). *Bat calls of New South Wales: Region based guide to the echolocation calls of Microchiropteran bats*. NSW Department of Environment and Conservation, Hurstville.

Reardon, T., Armstrong, K., Jackson, S. (2015). *A current taxonomic list of Australian Chiroptera*, Australasian Bat Society, Inc. Version 2015-05-15.

Reinhold, L., Law, B., Ford, G. and Pennay, M. (2001a). *Key to the bat calls of south-east Queensland and north-east New South Wales*. Queensland Department of Natural Resources and Mines, State Forests of New South Wales, University of Southern Queensland, and New South Wales National Parks and Wildlife Service, Australia.

Reinhold, L., Herr, A., Lumsden, L., Reardon, T., Corben, C., Law, B., Prevett, P., Ford, G., Conole, L., Kutt, A., Milne, D. and Hoye, G. (2001b). Geographic variation in the echolocation calls of Gould's wattled bat *Chalinolobus gouldii*. *Australian Zoologist* 31: 618-624.

Van Dyck, S. and Strahan, R. (Eds.) (2008). *The Mammals of Australia: Third Edition*. New Holland; Sydney.

From: Shannon Simpson
To: Adam Cavallaro
Cc: OEH ROD LMBC Support Mailbox
Subject: RE: Major Project - Mulwala Important Habitat Mapping LMBC-1656
Date: Tuesday, 29 May 2018 12:49:21 PM
Attachments: image002.png
image003.png

Hi Adam
Neither of those sites are within draft mapped important areas for the Swift Parrot or Regent Honeyeater.
The maps are in the process of being finalised but I couldn't say when they will be available.
Cheers
Shannon

From: Adam Cavallaro [mailto:Adam.Cavallaro@mjdenvironmental.com.au]
Sent: Tuesday, 29 May 2018 10:37 AM
To: Shannon Simpson <shannon.simpson@environment.nsw.gov.au>
Cc: OEH ROD LMBC Support Mailbox <lmbc.support@environment.nsw.gov.au>
Subject: RE: Major Project - Mulwala Important Habitat Mapping LMBC-1656

Hi Shannon,

Please find attached a copy of the Mulwala Shapefile (MSF).

I was wondering while you are checking this shapefile could you also check the additional attached file for a another project we am working on (for the same species).

Is there any idea of when the important habitat mapping will be available ?

Kind regards

Adam Cavallaro
Senior Ecologist
Accredited BAM Assessor # BAAS18056
MJD Environmental PTY LIMITED
2/235 Maitland Road, Mayfield
PO Box 360, Waratah NSW 2298
P: 0428 498 394
E: Adam.Cavallaro@mjdenvironmental.com.au

From: Shannon Simpson <shannon.simpson@environment.nsw.gov.au>
Sent: Tuesday, 29 May 2018 9:50 AM
To: Adam Cavallaro <Adam.Cavallaro@mjdenvironmental.com.au>
Cc: OEH ROD LMBC Support Mailbox <lmbc.support@environment.nsw.gov.au>
Subject: RE: Major Project - Mulwala Important Habitat Mapping LMBC-1656

Hi Adam

The mapping is still being finalised. If you would like to provide me with a shapefile or lot/dp of the area you are interested in I can check the draft mapping for you.
Regards
Shannon

Shannon Simpson
Project Officer - Ecosystem Assessment
Regional Operations Division
Office of Environment & Heritage
PO Box A290, Sydney South, NSW 1232
T. (02) 9995 5679
I work Mondays, Wednesdays, and alternate Tuesdays

From: OEH ROD LMBC Support Mailbox
Sent: Monday, 28 May 2018 3:49 PM
To: Shannon Simpson <shannon.simpson@environment.nsw.gov.au>
Cc: OEH ROD LMBC Support Mailbox <lmbc.support@environment.nsw.gov.au>
Subject: FW: Major Project - Mulwala Important Habitat Mapping LMBC-1656

Hi Shannon,

Can you please assist with this enquiry?

Kind Regards,

Fran Ryan
Land Management and Biodiversity Conservation
Contact Service Centre
Conservation Program
Office of Environment and Heritage
T: 1800 931 717
E:lmbc.support@environment.nsw.gov.au

NSW GOVERNMENT | Office of Environment & Heritage

From: Adam Cavallaro [mailto:Adam.Cavallaro@mjdenvironmental.com.au]
Sent: Monday, 28 May 2018 1:49 PM
To: OEH ROD LMBC Support Mailbox <lmbc.support@environment.nsw.gov.au>
Subject: Major Project - Mulwala Important Habitat Mapping

Hi

We are currently undertaking a Biodiversity Assessment for a State Significant Development in Mulwala (landholding north of Tocumwal Rd and West of Savernake Rd Mulwala).

I spoke with the local Albury OEH officer who has told me to refer this question back to the LMBC email.

As part of the impact assessment for the project we are trying to get a copy of relevant habitat mapping for the Regent Honeyeater and Swift Parrot.

To help inform the assessment would it be possible to receive information or a copy of important habitat mapping for the two bird species around the Mulwala area. We have a tight timeline for the project so any information would be greatly appreciated.

Please do not hesitate to contact me if you require any further information.

Kind regards

Adam Cavallaro
Senior Ecologist
Accredited BAM Assessor # BAAS18056

MJD Environmental PTY LIMITED

2/235 Maitland Road, Mayfield
PO Box 360, Waratah NSW 2298
P: 0428 498 394
E: Adam.Cavallaro@mjdenvironmental.com.au

This email is intended for the addressee(s) named and may contain confidential and/or privileged information.
If you are not the intended recipient, please notify the sender and then delete it immediately.
Any views expressed in this email are those of the individual sender except where the

From: David Hunter
To: Adam Cavallaro
Subject: RE: Request for Threatened Species Habitat Mapping
Date: Monday, 28 May 2018 1:39:25 PM
Attachments: image002.png

Hi Adam – amongst my emails from last week (when I was away) was an email stating that you need to direct this request to the address below:

lmbc.support@environment.nsw.gov.au

Cheers, Dave.

David Hunter
Threatened Species Officer, NSW Office of Environment and Heritage
T: 02 6022 0616
Mobile: 0439131593

From: Adam Cavallaro [mailto:Adam.Cavallaro@mjdenvironmental.com.au]
Sent: Monday, 28 May 2018 1:31 PM
To: David Hunter <David.Hunter@environment.nsw.gov.au>
Subject: RE: Request for Threatened Species Habitat Mapping

Thanks Dave.

Kind regards

Adam Cavallaro
Senior Ecologist
Accredited BAM Assessor # BAAS18056

MJD Environmental PTY LIMITED

2/235 Maitland Road, Mayfield
PO Box 360, Waratah NSW 2298
P: 0428 498 394
E: Adam.Cavallaro@mjdenvironmental.com.au

From: David Hunter <David.Hunter@environment.nsw.gov.au>
Sent: Monday, 28 May 2018 12:07 PM
To: Adam Cavallaro <Adam.Cavallaro@mjdenvironmental.com.au>
Subject: RE: Request for Threatened Species Habitat Mapping

Hi Adam – I forwarded your request on – I find where it got to.

Cheers, Dave.

David Hunter

Threatened Species Officer, NSW Office of Environment and Heritage
T: 02 6022 0616
Mobile: 0439131593

From: Adam Cavallaro [mailto:Adam.Cavallaro@mjdenvironmental.com.au]
Sent: Friday, 25 May 2018 10:15 AM
To: David Hunter <David.Hunter@environment.nsw.gov.au>
Subject: RE: Request for Threatened Species Habitat Mapping

Hi David,

I am just following up on my request regarding important habitat area maps for the Regent Honeyeaater and Swift parrot.

Wondering if you or the relevant person has had a chance to look at my request. We are needing this information to advise a major project and we are trying to work to a very tight deadline.

Any information on this matter would be greatly appreciated.

Kind regards

Adam Cavallaro
Senior Ecologist
Accredited BAM Assessor # BAAS18056

MJD Environmental PTY LIMITED

2/235 Maitland Road, Mayfield
PO Box 360, Waratah NSW 2298
P: 0428 498 394
E: Adam.Cavallaro@mjdenvironmental.com.au

From: Adam Cavallaro
Sent: Monday, 21 May 2018 1:25 PM
To: 'david.hunter@environment.nsw.gov.au' <david.hunter@environment.nsw.gov.au>
Subject: Request for Threatened Species Habitat Mapping

Hi David,

Thank you for speaking to me earlier.

We are currently undertaking a Biodiversity Assessment for a State Significant Development in Mulwala (landholding north of Tocumwal Rd and West of Savernake Rd Mulwala).

As part of the impact assessment for the project we are trying to get a copy of relevant habitat mapping for the Regent Honeyeater and Swift Parrot.

To help inform the assessment would it be possible to receive information or a copy of important habitat mapping for the two bird species around the Mulwala area. We have a tight timeline for the project so any information would be greatly appreciated.

Please do not hesitate to contact me if you require any further information.

Kind regards

Adam Cavallaro
Senior Ecologist
Accredited BAM Assessor # BAAS18056

MJD Environmental PTY LIMITED

2/235 Maitland Road, Mayfield
PO Box 360, Waratah NSW 2298
P: 0428 498 394
E: Adam.Cavallaro@mjdenvironmental.com.au

This email is intended for the addressee(s) named and may contain confidential and/or privileged information.
If you are not the intended recipient, please notify the sender and then delete it immediately.
Any views expressed in this email are those of the individual sender except where the sender expressly and with authority states them to be the views of the NSW Office of Environment and Heritage.

PLEASE CONSIDER THE ENVIRONMENT BEFORE PRINTING THIS EMAIL

From:	OEH ROD LMBC Support Mailbox
To:	Adam Cavallaro
Cc:	OEH ROD LMBC Support Mailbox
Subject:	RE: Streamline Assessment - Paddock tree assessment LMBC-1443
Date:	Tuesday, 29 May 2018 4:53:06 PM
Attachments:	image002.png image003.png

Hi Adam,
Thanks for the follow-up. I've replied (underlined) under a copy of your questions below. Any further questions, please let me know. Thanks for your patience with the paddock tree issues, which are still being refined.
Plot and transect field data for all vegetation mapping, ideally provided in spreadsheet format. This includes
Floristic survey data, comprising species lists and cover and abundance scores for each plot/transect
Scanned field data sheets (if used) or digital field survey data for each plot

We only undertook a paddock tree assessment due to the development area meeting the criteria for Paddock trees, therefore no BAM plot data was collected. We did collect flora species data (not in accordance with the BAM) while assessing the groundcover in the paddocks to confirm paddock tree criteria, is this data required to be included? E.g data sheets and species list

Yes, those species lists would still be useful to supply in order to confirm that the requirement for paddock trees has been met. Thanks.
The status of the "major project" and "offset" modules of the online credit calculator must be changed to "Submitted" to allow allocation to OEH officers.

As we are using the paddock tree assessment and the calculator is not available for this method, How are we to undertake the above requirement?
As the paddock tree calculator is still under development, the calculations for offset obligations will have to be done manually and be made available to OEH officers upon request.
It would probably be useful to provide these calculations as part of the BDAR to make explicit to any reviewers.

-
-

Kind Regards,

Fran Ryan
Land Management and Biodiversity Conservation
Contact Service Centre
Conservation Program
Office of Environment and Heritage
T: 1800 931 717
E:lmbc.support@environment.nsw.gov.au
Please ensure you keep all cc'ed parties included in any replies to this email.

Office of Environment & Heritage

-

From: Adam Cavallaro [mailto:Adam.Cavallaro@mjdenvironmental.com.au]
Sent: Monday, 28 May 2018 8:48 AM
To: Frances Ryan <Frances.Ryan@environment.nsw.gov.au>
Cc: OEH ROD LMBC Support Mailbox <lmbc.support@environment.nsw.gov.au>; Matt Doherty <Matt.Doherty@mjdenvironmental.com.au>
Subject: RE: Streamline Assessment - Paddock tree assessment LMBC-1443

Hi Fran,

I have a few more questions regarding the Streamline Assessment (Paddock tree) we are undertaking for the Major Project at Mulwala.

I believe we may have to undetake the following at the completion of the assessment, can you please provide further information on how we are to carry out each of the following:

- Plot and transect field data for all vegetation mapping, ideally provided in spreadsheet format. This includes
    - Floristic survey data, comprising species lists and cover and abundance scores for each plot/transect
    - Scanned field data sheets (if used) or digital field survey data for each plot

  We only undertook a paddock tree assessment due to the development area meeting the criteria for Paddock trees, therefore no BAM plot data was collected. We did collect flora species data (not in accordance with the BAM) while assessing the groundcover in the paddocks to confirm paddock tree criteria, is this data required to be included? E.g data sheets and species list

- The status of the “major project” and “offset” modules of the online credit calculator must be changed to “Submitted” to allow allocation to OEH officers.

  As we are using the paddock tree assessment and the calculator is not available for this method, How are we to undertake the above requirement?

Any information regarding the above would be greatly appreciated.

Kind regards

Adam Cavallaro
Senior Ecologist

Accredited BAM Assessor # BAAS18056

MJD Environmental PTY LIMITED

2/235 Maitland Road, Mayfield
PO Box 360, Waratah NSW 2298
P: 0428 498 394
E: Adam.Cavallaro@mjdenvironmental.com.au

From: Frances Ryan <Frances.Ryan@environment.nsw.gov.au>
Sent: Thursday, 3 May 2018 8:23 AM
To: Adam Cavallaro <Adam.Cavallaro@mjdenvironmental.com.au>
Cc: OEH ROD LMBC Support Mailbox <lmbc.support@environment.nsw.gov.au>
Subject: Streamline Assessment - Paddock tree assessment LMBC-1443

Hi Adam,

Happy to follow up:

- paddock tree zones should be mapped that align with ecological boundaries?? >>>Eco boundaries, does this refer to the canopy/ dripline of each paddock tree?

I probably complicated matters with this comment. In the case that you have, from photos, I'd suggest that the entire area is suitable for the paddock tree assessment. The alignment with ecological boundaries more refers to examples where grassy woodland intergrades into paddock trees. That's a little more complicated for the consultant to determine where 'grassy woodland' ends and 'paddock trees' start. In your case, the zones seem to meet the requirements for paddock trees and (pending the species and associated PCT) it may be appropriate to include them all in one 'paddock tree zone'

- Even though the Project is a State Significant Development, if on Cat 1(LLS Act) offsets do not apply? Does this include paddock trees on cat 1 land will not generate credits?

Yes and no. Offsets do not apply on Cat 1 land regardless of the development type. However paddock trees will almost always be Cat 2 land, by nature of the land (in most cases) not having been cleared at 1990. So in your classic paddock tree scenario, you will get the paddock tree (Cat 2) surrounding by exotic veg (Cat 1). The paddock tree still needs to be offset.

My expertise is more on paddock trees than SSD but I understand that prescribed impacts need also be considered on Cat 1 land.

- When you mention Paddock tree calculations need to be undertaken manually, is this by using table 12 Appendix 1 of the BAM?

That's right - you can use table 12 to calculate the ecosystem credits. Species credits are not calculated through this module, hence if any species credit species are known to be on the site, the full BAM must be used.

Kind Regards,

Fran Ryan
Land Management and Biodiversity Conservation
Contact Service Centre
Conservation Program
Office of Environment and Heritage
T: 1800 931 717
E:lmbc.support@environment.nsw.gov.au
Please ensure you keep all cc'ed parties included in any replies to this email.

This email is intended for the addressee(s) named and may contain confidential and/or privileged information.
If you are not the intended recipient, please notify the sender and then delete it immediately.
Any views expressed in this email are those of the individual sender except where the sender expressly and with authority states them to be the views of the NSW Office of Environment and Heritage.

PLEASE CONSIDER THE ENVIRONMENT BEFORE PRINTING THIS EMAIL

From: Frances Ryan
To: Adam Cavallaro
Subject: Streamline Assessment - Paddock tree assessment LMBC-1443
Date: Monday, 30 April 2018 4:17:08 PM
Attachments: image001.png

Hi Adam,

Thanks for your enquiry. I've provided some detail to your questions below in green. If you need any further clarification please feel free to get in touch.

Can you please provide some clarification for undertaking the assessment:
Can you confirm that the use of the streamline paddock tree assessment would be appropriate as it does meet the criteria outlined in Appendix 1 of the BAM;
The site sounds like it would be a candidate for the paddock tree assessment but I can't confirm without knowing fuller details of the site. Air photos would help if you can send them through. Generally the scattered nature of paddock trees is evident but you might need to check with LLS to get some guidance in the Category 1 or Category 2 status (noting that groundcover under the drip line is Cat 2 regardless of disturbance). The benchmark values for tree cover can be viewed in the BAM Calculator by entering the relevant PCT and viewing 'calculation results' in the Composition tab for the vegetation zone.
If you elect not to use the paddock tree module, it may still be useful to get assistance with Cat 1/Cat 2 land from LLS. Offsets do not apply on Cat 1 land, so the offset requirements can be proportionally reduced.

Can you please provide some guidance on how to undertake a streamline assessment using the BAM calculator for entering paddock tree data;
At the moment the paddock tree module is not part of the BAM calculator and the calculations have to be done manually. To demonstrate % tree cover relative to benchmark, paddock tree zones should be mapped that align with ecological boundaries (i.e. not manipulated to artificially decrease the proportion of tree cover). The list of predicted ecosystem species can be generated by intersecting the list from the appropriate PCT with species that use paddock trees as habitat as identified in the Threatened Biodiversity Data Collection.
The paddock tree module should not be used where threatened species, particularly species credit species, are known to be present. The regular BAM Calculations for development sites (BAM Chapters 4 -6) should be applied.
and
Tree windbreaks: There are a number of windbreaks that are located on the site. These appear to be around 20+ years old. The trees planted in these areas are primarily associated with the PCT that would have been present prior to clearing. There are some planted midstorey species, and the groundcover is generally absent with only exotic species observed. Windbreaks consist of up to 30 trees all >20DBH. Can you confirm if and how these windbreaks are to be assessed under the BAM?
Again, it is difficult to tell without knowing the precise details - if this land is covered by the LLS Act this vegetation may be classified as planted vegetation, or may be Cat 1 land, and not required to be offset. However, mature tree/shrub species in these landscapes often provide important habitat features to fauna. In the absence of any other supporting information I'd be

inclined to create a veg zone around the area of planted vegetation and do a veg integrity assessment.

Kind Regards,

Fran Ryan
Land Management and Biodiversity Conservation
Contact Service Centre
Conservation Program
Office of Environment and Heritage
T: 1800 931 717
E:lmbc.support@environment.nsw.gov.au
Please ensure you keep all cc'ed parties included in any replies to this email.